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INYUVESI YAKWAZULU-NATALI

A review of childhood mortality determinants in Zimbabwe during the economic crisis using data from the Zimbabwe Demographic and Health Survey, 2010-2011.

By

Emma Shuvai Chikovore

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COLLEGE OF HUMANITIES

DECLARATION - PLAGIARISM

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Dedication

To my children and all the children residing in Africa

Abstract

Background: The economic crisis that intensified in Zimbabwe between 2004 and 2009 could have exposed children under the age of 5 at an elevated risk of dying. The study investigates the determinants of childhood mortality in the country 4 years preceding the Zimbabwe Demographic and Health Survey of 2010-2011.

Aims and Objectives: To establish child mortality determinants in Zimbabwe for the period 2006-2010 during the economic crisis.

Methods: The study was a descriptive cross-sectional study which used data from the ZDHS 2010-2011. Using logistic regression and survival analysis, the study estimates the odds of dying and the survivorship probabilities for the birth cohort of 2006-2010.

Results: The results indicate that children born to mothers age 40-49 had 88% higher chances of dying compared to children born to mothers in the age group 15-19 in a model that controls for age of mother and gender of child. Female children had 23% lower chances of dying compared to male children in a model that controls for gender and age of mother and was statistically significant at p-value<.05. Children born to mothers with higher levels of education had 16% lower chances of dying compared to children born to mothers with lower levels of education in a model that controls for maternal education, age of mother and gender of child. Children residing in households with higher socio-economic status had 12% lower chances of dying than children residing in households with lower socio-economic status in a model that controls for household socio-economic status, maternal education, age of mother and child's gender. Children residing in rural areas had 17% lower chances of dying than children residing in urban areas in a model that controls for area of residence, household socio-economic status, maternal education, age of mother and gender of child. Children residing in some of the country's poorest provinces namely Matabeleland North and South had 72% and 70% lower chances of dying respectively and both were statistically significant at p-value<.05 in a model that controls for province of residence, area of residence whether rural or urban, age of mother, maternal education, gender of child and household socio-economic status.

Conclusions: The study established some of the determinants of childhood mortality during the country's economic crisis**.**

Key Words: Childhood mortality, determinants, millennium development goals

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List of Acronyms

AIDS	: Acquired Immune Deficiency Syndrome
DHS	: Demographic Health Survey
EAs	: Enumeration Areas
GoZ	: Government of Zimbabwe
HIV	: Human Immune Virus
ICPD	: International Conference on Population and Development
IMR	: Infant Mortality Rate
KM	: Kaplan-Meier
MDGs	: Millennium Development Goals
MoHCW	: Ministry of Health and Child Welfare
NGO	: Non-Governmental Organization
SMS	: Short Messaging Service
U5MR	: Under Five Mortality Rate
UN	: United Nations
UNICEF	: United Nations Children's Fund
VCT	: Voluntary Counselling and Testing
WHO	: World Health Organization
ZDHS	: Zimbabwe Demographic Health Surveys
ZIMSTAT	: Zimbabwe National Statistics Agency

CHAPTER 1- Study Background

1.0. Introduction of the chapter

Global child mortality levels, trends and determinants remains an important tool to assess milestones made so far towards achieving millennium development goals (MDGs) (Garenne and Gakusi, 2006). The MDGs campaign for a number of developmental goals that are to be met by year 2015. MDG number 4 appeals for a two-third reduction in childhood mortality between the year 1990 and 2015. When trends and determinants of mortality are noted they can be used as a tool to implement programs by governments and various agencies that are concerned with child welfare and child survival (Murray et al., 2007). More than three decades ago, the Alma-Ata declaration was reached to reduce global child mortality. A further reiteration was reached at the International Conference on Population and Development (ICPD) in 1994 when countries pledged to continue reducing childhood mortality and to do so by two-thirds between 2000 and 2015. The remarkable news is that most developed countries have already achieved the targets and there is progress towards reduction of childhood mortality in developing nations although slower than anticipated (Black et al., 2003). It is also important to take cognisance of the fact that although many developing nations have made progress towards meeting MDG number 4, the progress has not been adequate to meet the two thirds decline by the target year (Black et al., 2003). As 2015 draws closer it becomes a priority to re-examine what could be hindering some developing countries from meeting this important MDG. The economic structural adjustment aftermath, current global economic meltdown, the Human Immune Virus (HIV) pandemic and the diminished philanthropy gestures worldwide put child welfare and child survival especially in developing and middle income countries at an elevated threat as noted by Walker et al. (2002). According to the same authors, the HIV pandemic on its own has reversed the gains made towards reducing child mortality especially in sub-Saharan Africa, where childhood mortality increased by 7.7% in 1999 alone. The same authors Walker et al. (2002) also note that in 1999 alone there were 330 000 HIV related deaths of children younger than age 5 years in sub-Saharan Africa.

Chapter 1 will start by giving the child mortality situations globally, in sub- Saharan Africa and in Zimbabwe. Purpose of the study, context, problem statement, relevance, research aims and objectives and research questions related to the study will also be covered in this chapter.

1.1.Background of the study

Despite many studies that have investigated levels and determinants of child mortality, there is still a need to continue monitoring levels, trends and determinants of child mortality. Understanding the various determinants of childhood mortality support efforts to reduce the number of children who die unnecessarily especially in developing countries and to assess developmental needs (Murray et al., 2007). Furthermore, Ensor et al. (2010) suggests that there was also a need to assess the impact of current global economic recessions on levels and determinants of childhood mortality. The authors indicate that past experience has shown that economic recessions have a negative impact on child mortality especially in developing countries (Ensor et al., 2010). This makes this study relevant as it investigates some of the determinants of childhood mortality at the height of a recession. The austerity lifestyles that are experienced by populations who go through an economic recession could increase chances of infant and child mortality. Furthermore, Hill and Pebley (1989) note that the structural adjustment programmes that were adopted by many developing countries might have dampened efforts to reduce child mortality especially in these developing regions. It was with these points in mind that the study sought to find the determinants of childhood mortality in a country that has faced many economic challenges and fought pandemics such as the HIV pandemic and Malaria.

1.1.1. Global Perspectives on child mortality

In the social sciences domain there is a large pool of research literature related to levels, trends and determinants of childhood mortality examples being Black (1984; Mosley and Chen, 1984; Trussell and Pebley, 1984; Hobcraft et al., 1985; Yaukey et al., 2001; Caldwell, 1986; Hill and David, 1988; Ahmad et al., 2000;). This has been facilitated by the fact that the issue of child mortality and intentions to reduce childhood mortality is the fourth and one of the most important MDGs agreed upon by the international community. Estimates coming from most developing countries seem to suggest a slower decline and in some instance an increase in childhood mortality. Global figures presented in this section shows that a lot remains to be done in-order to reduce childhood mortality worldwide.

Global child mortality declined from 12.4 million deaths in 1990 to just 10.4 million in 2004 and declined further to reach 8.1 million deaths in 2009, suggesting a global health transition, characterised by a steady decline in mortality (Garenne and Gakusi, 2006). Soares (2007) and Black et al. (2003) point out that this transition can be traced back to the 1900s. The transition became more and more evident from then until the 2000s. Soares (2007) further attributes this transition in part to the global increase in per capita income, which translated to a rise in life expectancy at birth, from 45years to 75years.

So far many countries in the European region and Americas have managed to significantly reduce levels of infant and child mortality to reach mortality levels that range between 6 to as low as 2 per 1000 live births (Basu, 1989). According to the same report (Basu, 1989) mortality decline was larger in East Asia and the Pacific, Latin America and the Caribbean, and CEE/CIS, where countries managed to reduce mortality by half between 1990 and 2006. Despite this transition Murray et al. (2007) as well as Hill and Pebley (1989) were quick to note that the efforts being made and rate of child mortality decline globally now are no better than three decades ago especially in developing countries where the greatest number of child mortality is concentrated. In a report by (UNICEF et al., 2010), it is estimated that the bulk of the 22,000 deaths that occur every day worldwide are from developing countries. In the same report indicates that in 2009 alone developing countries contributed 98% of global child mortality. Sub-Saharan Africa seem to lead the pack where 1 in every 8 children in this region is likely to die before reaching the age of five compared to 1 in 167 in developed regions (UNICEF et al., 2010).

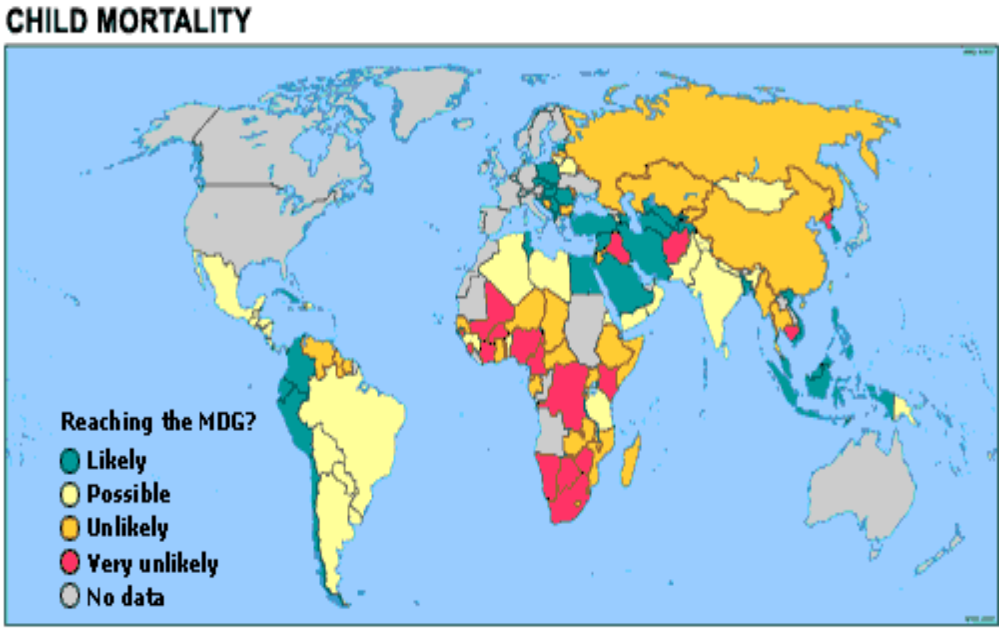
Despite the fact that developing countries have also seen an increase in per capita income, child mortality, together with other development goals, has fared poorly. Soares (2007) suggest that usually an improvement in per capita income translates to a reduction in mortality through different pathways that include access to better living conditions and access to health. However Hanmer et al. (2003) have argued out that child mortality levels can come down irrespective of income growth. Reiterating this point Caldwell (1986) states that what is needed to reduce child mortality is political and social will to address the issue of child mortality.

Nevertheless it is also important to acknowledge that the HIV/AIDS pandemic coupled with other socio-economic issues can worsen the plight of children especially those under the age of 5 (Walker et al., 2002). This can also apply within countries especially where inequalities are more pronounced, as those with access to resources are able to utilize state of the art

technologies and health services while those not politically or economically 'connected' experience high mortality. An example being a study in Jordan (Kaldewei and Pitterle, 2011) which found behavioural factors to play an important role in child mortality. This suggest that in countries that are considered to be middle-income countries, where there are relatively low levels of inequality, behavioural factors play an important role in determining child mortality.

There is a noticeable gap between developed and developing countries when it comes to child mortality. Unfortunately this current gap is too huge to be justified and energies can be channelled towards reducing these disparities. In agreement with UNICEF et al. (2010), it is important to take a look at the numbers of children who die in developing countries before the age of five and comparing them to the rest of the world. A good start is to have a look the world map below which gives a perspective on global child mortality according to regions and countries that are likely to achieve MDG goal number four by 2015 and those that are less likely to achieve this goal by this deadline.

Figure 1.1: Global map and child mortality prospects for global regions



Source of map: Sustainable world (2002) http://sustainableworld.org.uk/population.htm.

From the map it is clear that most countries that are labelled as least likely to achieve the two thirds child mortality declines by 2015 are in the sub-Saharan Africa and Asia. These regions

are also regarded as the poorest regions. For example Zimbabwe's external debt is estimated to be over US$10,000,000 (Muhuri and Preston, 1991).

1.1.2. Child mortality situation in sub-Saharan Africa

Between 1990 and 2009 child mortality in the sub-Saharan region declined by only 28 per cent yet other developing regions such as Eastern Asian, Western Asia, Latin America and Caribbean, Northern Africa and South-eastern Asia child mortality declined by more than 50 per cent (Basu, 1989). Many countries in the sub-Saharan Africa region still experience mortality above 50 deaths per 1000 live births triggering concerns that countries in the region will miss the MDG number 4 by 2015 (WHO, 2012a, Garenne and Gakusi, 2006, Ahmad et al., 2000) This is reaffirmed by Hill and Pebley (1989) and Murray et al. (2007) who note that while it is commendable that world-wide mortality has declined, Africa still contributes a higher percentage than the rest of the world. They indicate that in 2010 alone, while the rest of the world recorded 89 000 (33 000-177 000) under-five deaths, Africa recorded 435 000 (307 000-658 000). For example a report *Every Death Counts* produced by the South African government's department of Health together with its partners (DoH et al., n.d) suggests that 75 000 children die in the country every year before they reach their 5th birthday. The situation is made worse by the fact that the main causes of child mortality in developing countries especially in Sub-Saharan Africa are due to conditions that have been declared preventable and treatable, which according to UNICEF et al. (2011b) include neo-natal causes, pneumonia, diarrhoea, malaria and HIV/AIDS. The same report states that these five top killer diseases can be prevented using simple and affordable interventions. What is needed is the revived energy to reduce the incidence of these diseases among children in sub-Saharan Africa as these diseases account for 90 per cent of child deaths (WHO, 2012b).

1.2. Purpose of the study

The purpose of the study was to review determinants of child mortality in Zimbabwe using data from the most recent datasets of the Zimbabwe Demographic and Health Surveys (ZDHS) of 2010-2011**.** It is only though this process that we can know the circumstances that are hindering progress towards a meaningful reduction in childhood mortality. Furthermore the use

of survey data allows us to review mortality patterns by different political, socio-economic and cultural boundaries within a country. A review of child mortality trends and determinants (Marindo and Hill, 1997) found that some provinces in Zimbabwe had mortality advantage over others. What was rather intriguing was evidence of low child mortality in some of the provinces that are classified as poor in terms of service provision and infrastructure development. The determinants of childhood mortality investigated in this study reflect some of the determinants of mortality during the economic crisis.

1.3. Context of the study

Zimbabwe is home to some 13 million people and of these 1,706,000 or 13% are children under the age of 5 years (ZIMSTAT and ICF-International, 2012). The country is land locked with an estimated land area of 391 thousand square kilometres (km^2). It is bordered by Mozambique to the east, South Africa to the south, Botswana to the west and Zambia to the north. The country is divided into 10 administrative provinces and these provinces are further divided into 210 smaller districts. According to UN-OCHA (2013)70 % of the population live in communal areas. On the United Nations Human Development Index the country is ranked number 151 out of 177 countries (ICF-International, 2011). The country is one of the countries heavily burdened by both HIV and TB, making efforts to reduce child mortality even difficult. Between 1997 and 2008, the country experienced one of the worst economic situations in the twenty first century (UNICEF et al., 2011a). According to a report by IMF (2008) the country's inflation rate reached 2,000,000% in 2008. In the hyper-inflationary economy many families could not sustain their livelihoods including health provision. According to UN-OCHA (2013), since 1998 the country has experienced outbreaks of life threatening and highly contagious diarrhoeal diseases such as cholera, typhoid fever and dysentery.

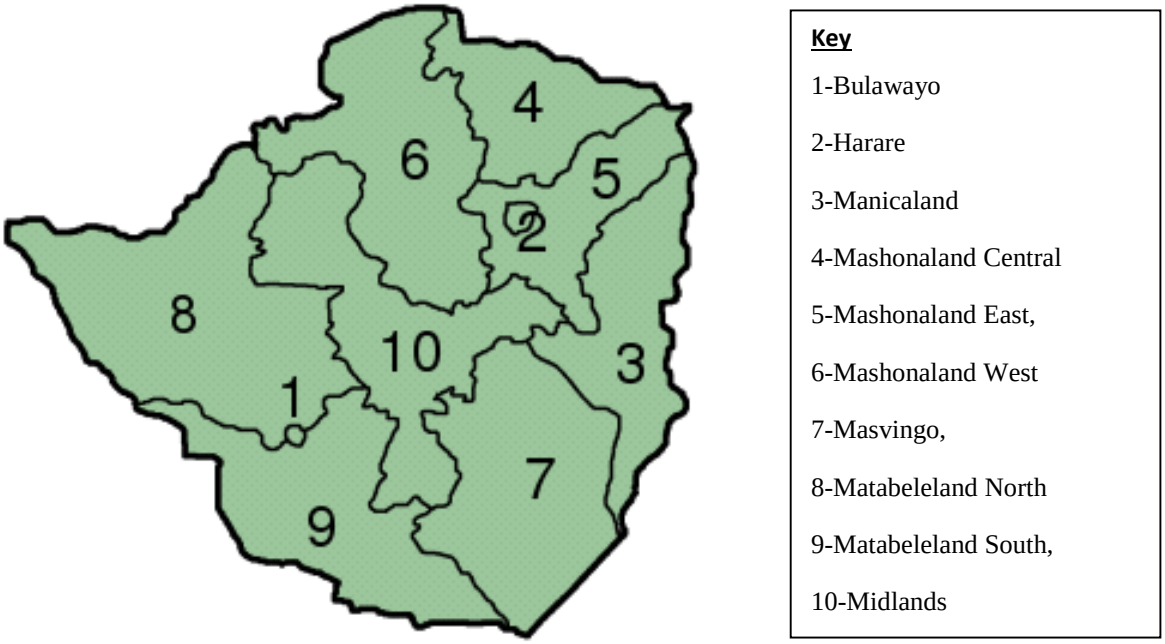
During the peak of the economic crisis, private hospitals and doctors charged their consultation fees in foreign currency to remain viable, making their services out of reach to the majority of the population especially those in rural areas. As noted by G.o.Z and UN (2010) the requirement for user fees coupled with the HIV pandemic and chronic malnutrition that was prevalent during the time under review contributed to the increase in child mortality. Many non-governmental organizations (NGOs) working in the country's health provision services were overwhelmed as government institutions battled to stay afloat. The situation was further exacerbated by the ever rising medical costs and by the exodus of health professionals who

migrated to neighbouring and overseas destinations looking for 'greener pastures' (UNICEF et al., 2011a).

According to (UNICEF et al., 2010), the economic meltdown resulted in 50% contraction in gross domestic product (GDP) and forced two thirds of the population to live below the poverty datum line. Government spending on infrastructure and other important services came to a virtual standstill. Many NGOs that provided essential relief services in the country could not sustain their activities and had to scale down or close business.

Figure 1.2 below is a map of Zimbabwe and the 10 provinces that make up the country and names of each. The economy of the country is agricultural based.

Figure 1.2: Zimbabwe map divided into 10 provinces

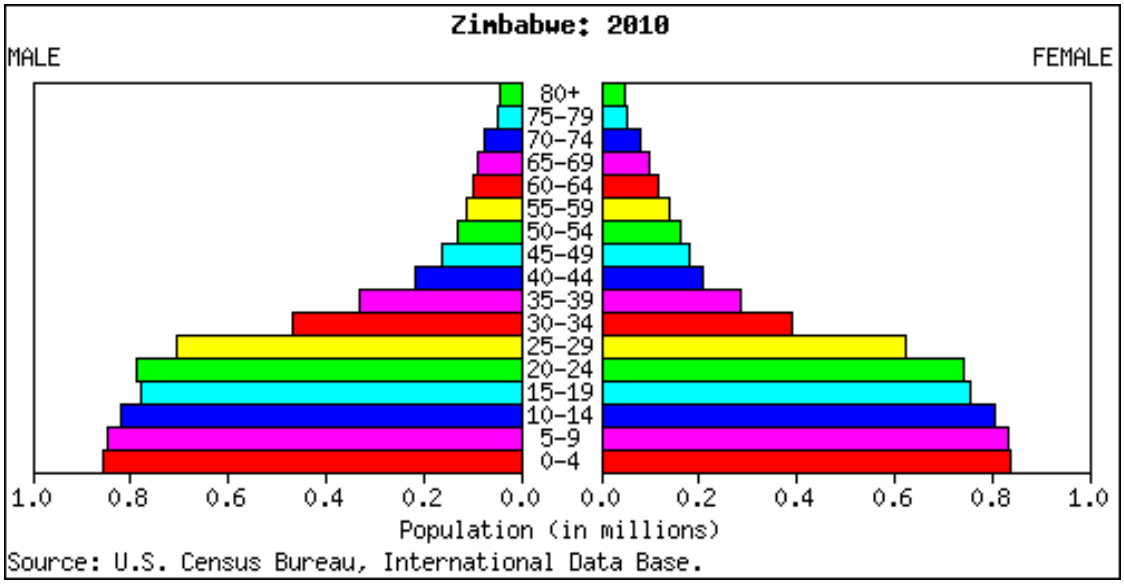


Source of Map: Wikimedia Commons;
http://commons.wikimedia.org/wiki/File:Zimbabwe_Provinces_numbered_300px.png.

Majority of the population is below the age of 65; hence it is considered a young population. The age structure is best represented by the population pyramid below. The pyramid is broad at the base and narrow at the top to indicate a young population. From the pyramid it is also

apparent that population in the age category 0-4 is huge than any other age category. This age category also requires more medical attention than any other to survive to the next age category.

Figure 1.3: Population pyramid for Zimbabwe



Source: U.S Census Bureau. http://www.nationmaster.com/country/zi-zimbabwe/Age-_distribution.

It was against this backdrop that this study sought to investigate some of the determinants of childhood mortality during the economic downturn. Studies have shown that child mortality escalates during economic crises as was noted in Cameroon by Pongou et al. (2006). Furthermore establishing the determinants at any given point in time becomes important as child mortality levels and subsequent patterns have a bearing on the population structure of any society. Child mortality in particular is an important tool to assess the effectiveness and efficiency of health programmes, level of development of any country and for policy interventions. According to Breman et al. (2001), monitoring of under-five mortality trends is used as a monitoring tool for most developing countries.

There has been consensus among different authors on the fact that child mortality in Zimbabwe declined to some extent since the end of the 1960s and significantly so in the 1970s and also that it has been fluctuating ever since (Marindo and Hill, 1997). Some of the reasons that have been cited as being responsible for this fluctuation include the HIV/AIDS pandemic, resurgence of drug resistant malaria, increase on other childhood diseases and the economic meltdown experienced since the 1990s (MoHCW, (n.d).).

1.4. Problem Statement

UNICEF et al. (2011a) note that, Zimbabwe as a country has achieved little progress towards achieving MDGs number 4 and 5 which are goals meant to reduce child and maternal mortality respectively. Nevertheless the country is privileged to have conducted surveys and censuses that allow us to assess the extent of this problem and identify determinants of mortality. Thus the purpose of this study was to review levels and determinants of child mortality in Zimbabwe for the period 2006 to 2010 using the most recent data from ZDHS of 2010-11. Constant reviewing of under-five mortality levels and determinants remains a vital tool for policy re-evaluation purposes, implementation and for monitoring and evaluation of health programmes, including donor funded projects. Once identified, levels and determinants of mortality are a guiding tool to addressing sources of health inequalities within a country and to address unmet health needs by improving health provision services to areas that are deprived of those services.

1.5. Relevance of the study

Besides being used as a program evaluation tool, determinants of childhood mortality also facilitate policy changes and inform interested parties such as donor community. The determinants of childhood mortality investigated in this study will help understand determinants that are likely to be effective in an economic crisis situation. The results from this study are expected to contribute to already existing literature and hopefully highlight important determinants of childhood mortality in a developing country context faced with economic crisis in a bid to highlight impediments to achieving MDG targets by 2015. Efforts to reduce child mortality can only be given priority and a sense of urgency if the extent of the problem is well known together with issues that are hampering efforts to reduce child mortality are clearly defined. Furthermore child mortality patterns have a direct bearing on the fertility patterns as parents try to compensate for lost children (Muhuri and Preston, 1991) . Through reviewing child mortality levels and what drives mortality, it is possible to link mortality and fertility levels, determinants, differentials and determinants within a country. Furthermore Trussell and Pebley (1984) imply that availability of family planning programmes in a society might in itself reduce child mortality by close to 5 to 21 per-cent when childbearing is confined to women of reproductive ages of 20 to 34. On the other hand most similar research on determinants of child mortality were done in the 1980s and early 1990s making the results from those studies outdated hence it was important to identify emerging issues that have an impact on child

mortality. Policy implementers cannot afford to keep on focusing on maternal education for example, given the fact that globally there has been an almost universal education attainment, yet child mortality is not declining to reach levels that are considered acceptable. As Caldwell (1986) notes, education can only have an impact on mortality if it helps to understand the scientific causes of diseases.

1.6. Research aims and objectives

The main objectives of the study were.

- To establish child mortality determinants in Zimbabwe for the period 2006-2010 during the economic crisis.
- To identifying some of the factors that are hampering efforts to reach goal number four in Zimbabwe.

1.7. Research questions

The research questions for the study were

- What were the determinants of child mortality in Zimbabwe for the period 2006 to 2010 at the height of the economic crisis?
- Are the determinants of childhood mortality as proposed by Mosley and Chen (1984) relevant in a country faced with economic challenges?
- Are there any mortality differentials by subgroups, for example female children against male children, rural and urban mortality variations, lower household socio-economic status against higher household socio-economic status?

1.8. Hypotheses for the study

The hypotheses for the study were

- In a hyper inflationary economic situation the well-established determinants of childhood mortality such as maternal education cease to have a positive impact on childhood mortality.
- During the economic situation, other determinants of childhood mortality emerged.

- During the time under review there were mortality variations among subgroups.

1.9. Definition of Terms

Definition of some terms that were used in this study is presented on this section.

Infant Mortality Rate (IMR)- The probability of dying between 0-12 months of life and is expressed as deaths per 1000 live births

Childhood Mortality (U5MR) - is the overall childhood mortality.

Determinants- Factors that are likely to have an influence on mortality.

1.10. Dissertation outline

Presented on this section is the dissertation outline for the study. Chapter 1 covered background of the study. The background section introduces the issue of child mortality and highlights what is known about child mortality so far. Purpose, context and problem statement, relevance of the study, research aims and objectives, research questions, hypotheses statements and definition of terms are also presented in chapter 1. In chapter 2 issues related to literature on child mortality and the proposed theoretical framework are covered. Chapter 3 is the methodology chapter which looks in detail the methods that were used for the study and also a description of sources of data. Chapters 4 and 5 present the results of the study. The last chapter for this study, which is chapter 6, presents a summary of the results, recommendations related to the study and ends with the conclusion of the study.

1.11. Conclusion of the Chapter

Chapter 1 was dedicated to discussing global, rest of Africa, sub-Saharan African and in particular the Zimbabwean child mortality burdens as the background of the study. In this chapter the relevance of the study, problem statement, research aims and objectives, research questions and lastly the conceptual framework that informed this study were outlined.

CHAPTER 2- Review of Literature

2.0. Introduction of the chapter

Research on levels and determinants of childhood mortality has dominated the field of demography and population studies since the 1960s through to the 1990s as noted by (Kaldewei and Pitterle, 2011). Nevertheless, the 1980s and 1990s ushered in a new perspective towards the study of childhood mortality as it was a time to take seriously the intertwined nature of child mortality with other issues such as poverty, inequality and gender disparities (UN, 2011, Gakidou et al., 2010). Stressing the significance of the relationship between child mortality and other socio-economic issues, Desai and Alva (1998) argue that it is often precarious to focus on maternal education alone as the dominant determinant of childhood mortality as was the tradition in the study of child mortality in the 1960s and the 1970s. Desai and Alva (1998) further argue that from the 1980s up to date there has been a transformation and efforts are constantly being made to acknowledge the important role played by other determinants of child mortality. Supporting this argument Croghan et al. (2006) (p334) cite other important factors such as "strong economy, education, adequate nutrition, equity, and effective government; a functioning public health system that provides sanitation, clean water, and infection control; and a comprehensive primary health care delivery system" that are required to address MDGs especially child mortality.

Although the world has become more dynamic and has become a global village, there are evident health and mortality disparities between the developed and developing countries as noted by Black et al. (2003). Rates of child mortality discussed in this chapter indicate that despite global child mortality decline, the developing countries still contribute a higher percentage than the developed countries (UNICEF et al., 2010, WHO, 2012a, Ensor and Cooper, 2004, Nakamura et al., 2011, Hill and Pebley, 1989). The numbers of children dying in some developing countries are still too high to meet the MDG goal number 4 within the next two years (UNICEF et al., 2010, WHO, 2012a, Ensor and Cooper, 2004, Nakamura et al., 2011, Hill and Pebley, 1989). Furthermore, Houpt and Guerrant (2006) have acknowledged that since the Alma Alter global commitments to reduce global child mortality, only 5.5 million child deaths have been prevented. The purpose of this chapter is to look closely at these levels and determinants of childhood mortality as noted by other researchers and institutions that are concerned about child mortality. Retrospective global levels, sub-Saharan Africa region and Zimbabwe levels of childhood mortality are revisited in this chapter. Retrospective levels of

childhood mortality help us understand trends, to position ourselves on where we are going and most importantly the effort needed to address this challenge. Also discussed here are the two conceptual frameworks that guided this study together with some of the factors that are slowing down progress towards meeting the global and country commitments to reduce child mortality by two-thirds until 2015.

Two rates of childhood mortality that are presented in this chapter are the Infant Mortality Rate (IMR), which is the probability of dying between birth and exact age 1 year and the Under-five mortality U5MR, which is the probability of dying between birth and exact age 5. Both IMR and U5MR are good indicators of childhood mortality. IMR is a good indicator of both medical and public health conditions and initiatives, while U5MR is preferred to other indicators of child mortality because it represents collective mortality throughout childhood (Muhuri and Preston, 1991, Hill and Pebley, 1989).

2. 1.Global levels of childhood mortality

Organizations such as United Nations (UN), United Nations Children's Fund (UNICEF), World Health Organization (WHO), United Nations Development Programme (UNDP), United Nations Population Division (UNPD) and The World Bank are at the forefront, producing annual childhood mortality levels for all the countries. Besides these organizations, surveys such as World Fertility Survey (WFS) and Demographic and Health Surveys (DHS) also produce child mortality estimates. Levels of childhood mortality produced by all these organizations save several purposes. According to Murray et al. (2007) and Hill and David (1988), levels of childhood mortality are used to identify regional and country developmental needs. The results are used for directing resources and support where it is needed most and lastly for monitoring and evaluation purposes.

Walker et al. (2002) suggest that the world has seen a slow but steady decline in child mortality since the 1960s when child mortality was estimated to be around 18 million deaths annually. By 1978 when the Alma-Ata declaration was signed, it is estimated that 15 million children were dying annually (Houpt and Guerrant, 2006). In 1980, two years after the declaration was made, the absolute number of children dying had fallen down to 13.5million deaths world-wide (Murray et al., 2007). Ahmad et al. (2000) note that global child mortality decline rate peaked around the 1980s and was witnessed in both developed and developing countries. Since renewed global commitments in 2000 to reduce childhood mortality by two-thirds between

1990 and 2015 and to address other developmental goals, there has been another notable decrease in the levels of childhood mortality world-wide although at a slower rate than anticipated (Walker et al., 2002, Croghan et al., 2006, Hanmer et al., 2003, Ahmad et al., 2000, Black et al., 2003, UNICEF et al., 2012b). According to Black et al. (2003) by 2000 the absolute number of children dying had come down to 10.8 million child deaths worldwide. It is estimated that in 2005, 9.7 million children under the age of five lost their lives (Murray et al., 2007). Year 2007 marked 29 years after the Alma-Ata declaration and the figures had gone down further to 9.2 million children dying before the age of 5 years worldwide (Houpt and Guerrant, 2006). UNICEF et al. (2012b)report that in 2011 the figure of children dying annually stood at 6.9 million. Houpt and Guerrant (2006) indicate that between 1990 and 2007, global rate of child mortality declined by 27% from 93 deaths per 1000 live births to 68 deaths per 1000 live births. Furthermore, WHO (2012a) estimates that globally child mortality rates declined by 2.2% annually between 1990 and 2010. These figures are slightly higher than those reported by UNICEF et al. (2010) who observe that between 1990 and 2009 global child mortality rate declined from 89 deaths per 1000 live births to 60 deaths per 1000 which translates to 22000 deaths per day. In 2011 the number of children dying every day had declined to 19000 deaths per day (UNICEF et al., 2012a).

Although estimates produced by WHO (2012a) for the same period are slightly lower than those produced by UNICEF, they are within the same range and put the figures at 88 deaths per 1000 live births for 1990 and 57 deaths per 1000 live births for 2010. (UNICEF et al., 2010) indicates that of the 67 countries that have higher childhood mortality, only 10 are likely to meet the MDG target. This is reaffirmed by Hill and Pebley (1989), Murray et al. (2007) and Murray et al. (2012) who all acknowledge the decline of mortality world-wide, but note that Africa still contributes higher figures than the rest of the world. In 2010 alone while the rest of the world recorded 89 000 (33 000-177 000) under-five deaths, Africa recorded 435 000 (307 000-658 000) (Murray et al., 2012). Yet, already most countries in the European region and Americas have managed to reduce levels of infant and under-5 mortality rates to reach mortality rates that range between 6 to as low as 2 per 1000 live births (UNICEF et al., 2007). According to the same author regions of East Asia and the Pacific, Latin America and the Caribbean, and CEE/CIS, have recorded the largest number of child mortality decline. Most countries in these regions have managed to reduce mortality by half between 1990 and 2006. According to Hanmer et al. (2003), some African countries have also experienced child mortality declines that are commendable and they have done that in the back of falling GDP.

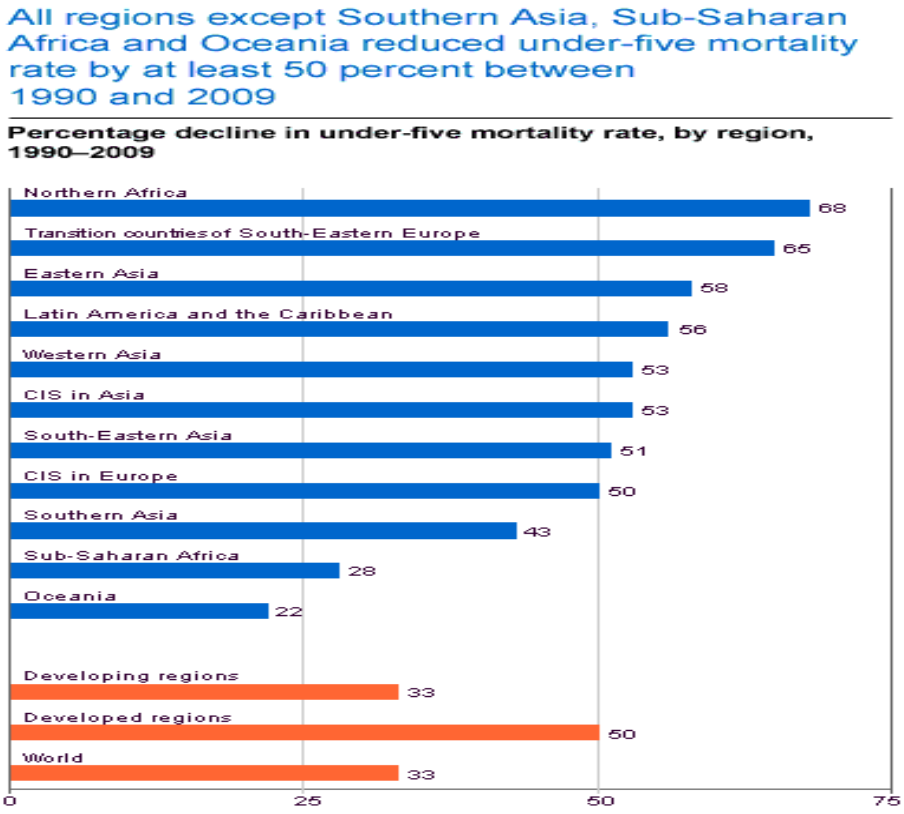
On the other hand, childhood mortality in some Middle East has come down because of increased income from oil exports (Hanmer et al., 2003). Such observations are a testimony that child mortality can in some cases decline independent of economic growth, although in others economic growth has to occur first.

Although several researchers and policy makers have generally welcomed childhood mortality decline in many parts of the world, some have done so with reservations highlighting that a lot still remains to be done especially in developing countries in-order to address the issue of childhood mortality (Ahmad et al., 2000, Black et al., 2003, Cleland et al., 1992, Walker et al., 2002). Others have gone further to suggest that there was need to acknowledge the challenges that developing regions had to deal with first, before identifying impediments to achieving child mortality levels close to those achieved in developed regions of the world (Croghan et al., 2006). These challenges include the economic slowdowns, conflicts, and famine and disease epidemics. However, reasons that although developing regions have challenges, in some instances high rates of childhood mortality that are still being experienced in many developing societies can be largely or partly attributed to lack of political and social will to address the issue.

Caldwell (1986) further points that the lack of political and social will to address child survival issues can have far reaching consequences. The author points out that that there were 'disconnected approaches' in dealing with child survival issues, hence this slow progress towards achieving lower childhood mortality rates. In the same paper, the author also suggests that there is no packaging of intervention strategies to abate childhood mortality, as a result programs that are meant to save children are fragmented and there is no coherence among these different programs. The author further describes the existence of insufficient consideration to wider health system incapacities. The other factor that is implicated as a hampering factor to addressing child mortality is the issue of broken linkage which is emphasised as a blockage to achieving acceptable rates of childhood mortality in developing countries (Caldwell, 1986).

Figure 2.1 below shows WHO regions and percentage of decline in childhood mortality between 1990 and 2009. It also shows the percentage of decline in developed, developing and world regions according to UN.

Figure 2.1: Percentage decline in under-5 mortality rate by region, 1990-2009



Graph taken from United Nations Inter-agency Group for Child Mortality Estimation (2010). http://www.childinfo.org/files/Child_Mortality_Report_2010.pdf.

2.2. Levels of childhood mortality in sub-Saharan African

Like most of the world regions, sub-Saharan has also seen a decline in child mortality albeit at a slower rate than the other regions (UNICEF et al., 2012b). It is important at this stage to acknowledge that the region's efforts to reduce childhood mortality suffered a huge blow since the 1990s due to the spread of HIV/AIDS and other challenges that include economic and political instability, dwindling support and fatigue by both African governments and funders to continue addressing issues of child survival (Hallett et al., 2010, Walker et al., 2002). According to UNICEF et al. (2010), since 1990 the region has witnessed a notable decline in under-five mortality rates but the absolute number of children dying actually increased from 4 million in 1990 to 4.4 million deaths in 2008. This increase in the absolute number of children dying was facilitated by slow progress towards child mortality decline but at the same time stable high fertility within the region (UNICEF et al., 2010) A report produced by UNICEF et al. (2011b) shows that although the fact still remains that most child deaths happen in sub-

Saharan Africa compared to other regions, some countries within the region have done exceptionally well to reduce child mortality. Some countries have seen a drop of child mortality of at least 50%. The document cite countries such as Malawi, Madagascar, Eritrea, Liberia and Niger are countries that have managed to reduce child mortality by at least 50% (UNICEF et al., 2012b) Nevertheless other countries within the region are still battling to reduce child mortality by more than 10%, contributing high levels of mortality thereby making sub-Saharan Africa the most burdened region (Murray et al., 2007). Among the countries that have been mentioned as battling to reduce child mortality by less than 10% are Central African Republic (CAR), South Africa, Democratic Republic of Congo (DRC), Lesotho, Burkina Faso, Somalia, Chad and Zimbabwe (UNICEF et al., 2012b). A report *Every Death Counts* produced by the South African government's department of Health together with its partners suggests that 75 000 children die in the country every year before they reach their 5th birthday (DoH et al., n.d). The individual countries cited above still experience mortality above 50 deaths per 1000 live births, triggering concerns that these countries are definitely going to miss the MDG target of 2 thirds decline by the year 2015 (Garenne and Gakusi, 2006, WHO, 2012a, Ahmad et al., 2000).

According to Black et al. (2003), sub-Saharan Africa contributed 41% of the 10.8 million child deaths that occurred in 2000 and the other regions of the world shared the remaining 59%. UNICEF et al. (2012b) suggests that sub-Saharan Africa is one of the regions which is showing least progress towards achieving MDG goal number 4 by the year 2015. Nevertheless despite the region being the region which is not likely to meet its target by 2015, it is also the region which has seen a faster decline in child mortality since 1990. The same report notes how the annual rate of decline doubled in the last two decades (UNICEF et al., 2012b). From figure 2.1 it is clear that between 1990 and 2009 child mortality in the sub-Saharan region declined by only 28 per cent, although other regions including other developing regions such as Eastern Asian, Western Asia, Latin America and Caribbean, Northern Africa and South-eastern Asia child mortality declined by close to 50% or more (WHO, 2012a). WHO (2012a) also suggests that 15% of children born in sub-Saharan Africa will not make it to their fifth birthday compared to 3-8% in other parts of the world.

It is important however at this point to note that there is still hope for under-performing countries in sub-Saharan Africa to do better and reproduce similar results as those achieved by their counter-parts in Northern Africa where child mortality declined by 68 per cent between 1990 and 2009 (UNICEF et al., 2010). As Caldwell (1986) and (1990) states, what is needed

to reduce child mortality is the political and social will. The author also notes that countries such as Kerala (Indian State), Sri Lanka, Costa Rica and China have managed to reduce child mortality significantly due to both political and social will by their governments in the back of weak economies. Caldwell (1992) also suggests that developing nations are better placed to reduce child mortality at a faster rate than that experienced by developed nations because they are privileged to borrow medical technology from developed nations. It from this study will highlight how countries can adapt to advanced communication technology and harness current medical advancement to the advantage of child survival, irrespective of economic situation. For example Information and Communication Technology (ICT) can be used to alert people of disease outbreaks and has been used successfully in Uganda to advance the concept of telemedicine (Omona and Ikoja-Odongo, 2006). Furthermore Tamrat and Kachnowski (2012) have proposed that ICT can be used to complement efforts to achieve MDGs in developing countries.

2.3. Levels of childhood mortality in Zimbabwe

Besides child mortality estimates that are produced annually by the international organizations in collaboration with the government of Zimbabwe, child mortality estimates come from surveys such as ZDHS and censuses that are conducted after every 5 and 10 years respectively since the country's independence from Britain in 1980. The country had targeted to reach child mortality rate of 26 per live births by 2015 (UNICEF et al., 2010, UNICEF et al., 2011b), nevertheless the levels presented here indicate that this is no longer possible due to the slow rate of decline. For example a recent report (UN-OCHA, 2013) indicates that about 4,000 children under the age of 5 die from diarrhoeal diseases alone every year. The country's child mortality started declining significantly from the 1960s suggesting the beginning of a mortality transition (Marindo and Hill, 1997). By 1990 the country had managed to reduce the number from three digits to two digits with estimated mortality rate of around 78 deaths per 1000 live births. This number was almost close to half the number of death experienced in 1970 when the country had child mortality estimates of 120 deaths per 1000 live births (UNICEF et al., 2011b, Hallett et al., 2010). Results from ZDHS 1988 indicate that in 1988 IMR was 52 deaths per 1000 live births and Under-five mortality was 75 deaths per 1000 live births. According to Marindo and Hill (1997), this decline witnessed in the country was in line with other countries

in the region although at a slower rate compared to neighbouring countries with same economic status such as Botswana.

Marindo and Hill (1997) attributes this decline of child mortality that occurred immediately after independence in 1980 to increase in maternal education, positive economic growth and immunization programmes that were initiated around the same time. By 1994, the country had managed to reduce child mortality to 77 per 1000 live births. Nevertheless this decline was short lived, as child mortality began to take hold again when the country started experiencing an economic crisis at the second half of the 1990 decade. According to UNICEF et al. (2011b), by the end of the decade in 1999, child mortality had risen again to three figures when the country recorded 102 deaths per 1000 live births. Child mortality was to remain fluctuating in the next 15 years mainly due to economic challenges and the HIV/AIDS challenge (MoHCW, (n.d).)

Figure 2.2: Levels of IMR & U5MR for Zimbabwe from 1973-2010

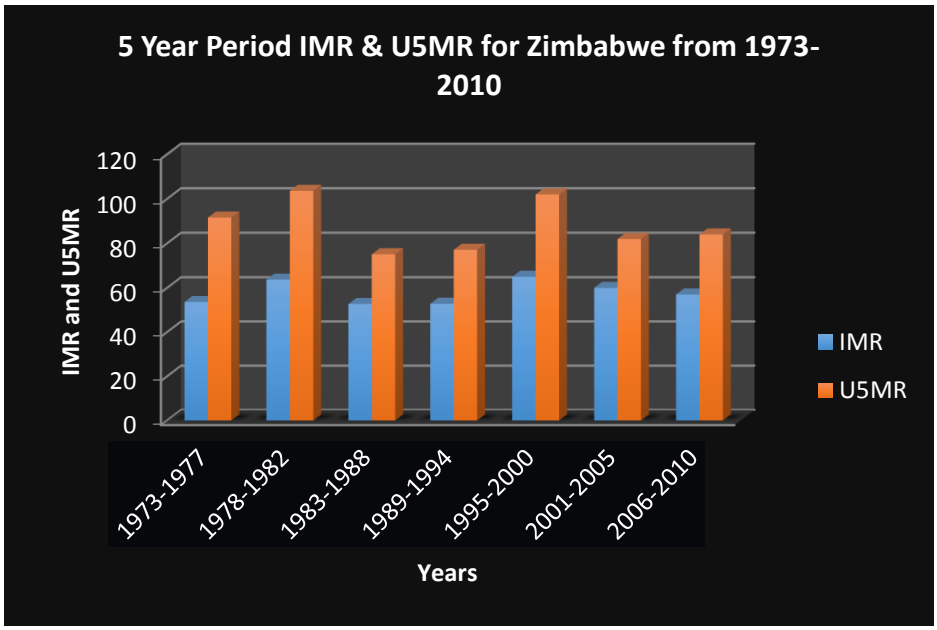


Figure based on data from ZIMSTAT and ICF-International (2012)

In 2009 child mortality rate declined slightly and was estimated to be 90 deaths per 1000 live births and in 2010 the number had come down to 80 deaths per 1000 live births (UNICEF et al., 2010) Other rates of child mortality such as Infant mortality and neo-natal mortality followed similar trends. These figures by UNICEF are not very different from rates produced by ZDHS, suggesting that rates only differ because of different methods used to estimate child

mortality. Figure 2.2 displays 5 year period IMR and U5MR for Zimbabwe from 1973 to 2010 based on figures from 4 DHS.

From the figure 2.2 it is apparent that child mortality in Zimbabwe has been floating below 100 deaths per 1000 live births for two decades after its independence but went above 100 at the beginning of the economic down-turn around the year 2000. Hill and Pebley (1989) suggest that countries or societies that pass through economic reforms are likely to experience high child mortality as a consequence of the negative impact of economic reforms. The writers further indicate that reduced spending by governments on health programmes and other important sectors of the economy subsequently result in upward child mortality. Besides the worst economic challenges that started since 2000 in the history of the country, the country like most of the countries in the sub-Saharan region is facing many health challenges that are a direct result of the HIV/AIDS epidemic and resurgence of malaria among other challenges (Hallett et al., 2010). The prevalence rate of HIV among adults 15 years and above was 14.3 per cent in 2009. HIV prevalence rate among pregnant women was slightly higher and was estimated to be 16.1 per cent in 2009 (G.o.Z and UN, 2010). United Nations AIDS (UNAIDS, 2010) reports that in sub-Saharan Africa, "more women than men were living with HIV, and young women aged 15–24 years are as much as eight times more likely than men to be HIV positive". These statistics show that young women in their reproductive ages are the ones being infected most by the virus, in the absence of, or limited interventions such as easy access to Voluntary Counselling and Testing centres (VCTs) and Prevention of Mother to Child Transmission Programmes (PMTCT) this translates to more HIV exposed babies. Since the beginning of the HIV pandemic, the country has seen an increase in the number of children affected by the virus through vertical transmission (G.o.Z and UN, 2010).

On the other hand, although malaria is seasonal in the country, more than half of the population (60%) reside in malaria prone zones and evidence suggest that there has been notable incidences of the disease during the rainy season which is between December and April (Mharakurwa et al., 2004). Expectant mothers, children under the age of five and people living with HIV/AIDS have higher risk of contracting the disease (Mharakurwa et al., 2004, Munhenga et al., 2008) (WHO, 2008, WHO, 2009). Efforts to control malaria have been in place since the late 1940s with programmes such as indoor residual spraying (IRS), use of insecticide-treated nets (ITN) and the roll back malaria initiative implemented by the Ministry of Health and Child Welfare (MOH&CW) in partner-ship with such organizations as WHO. Despite these efforts nevertheless, results from the Zimbabwe Demographic and Health Survey

(ZDHS) of 2005-06 suggest low use of bed-nets among populations at high risk (CSO and Macro-International.Inc, 2007). The usage of ITNs was low to the extent that only 20% of the population interviewed had one bed-net per household, only 7% of the population interviewed had more than one bed-net (CSO and Macro-International.Inc, 2007).

2.4. Demographic and Proximate Determinants of childhood mortality

Many authors have written unequivocally over the years on the role of demographic, the proximate and distal or underlying determinants of child mortality in many societies (Mosley and Chen, 1984, Caldwell, 1986, Hobcraft, 1993, Das Gupta, 1990, Wang, 2003, Tekce and Shorter, 1984, Hobcraft et al., 1985). Most of these authors seem to agree that child mortality patterns differ within same societal boundaries and many agree on the important role of factors such as maternal education, age of mother at birth, birth spacing, household or community socio-economic status, environment, spatial distribution, cultural, religious and other social beliefs, community/country health care system and area of residence in alleviating childhood mortality especially in developing countries. According to (Das Gupta, 1990) and (Caldwell, 1992), although maternal education still plays an important role in health outcomes of any child, it is perilous to ignore other determinants of child mortality, as they play an equally important role in determining morbidity and mortality patterns. Caldwell points out that this rather unfortunate mentality by researchers to undermine other determinants of mortality can be easily be attributed to the fact that information related to parental education is readily available in most of the surveys and censuses yet other determinants are not given the attention they deserve (Caldwell, 1992). It is against this background that it was also imperative to understand other determinants of child mortality that are at play in the country by understanding determinants across households, cultures and different political boundaries within Zimbabwe.

Proximate determinants of child mortality have been described as factors that have a direct influence on the risk of disease and the outcomes of disease processes in individuals (Caldwell, 1992). These include personal attitudes and behaviours, environmental exposures, nutrition, injuries and personal illness control (Caldwell, 1990, Das Gupta, 1990). Pitt (1997) further reiterates that to a large extent, households and communities themselves have an important role to play in determining child morbidity and mortality hence must be given the same attention as other determinants of child mortality. Kaldewei and Pitterle (2011) further suggest that once countries achieve a certain economic threshold, maternal education alone cannot be used to

explain child mortality. They suggest that what could be used to explain child mortality in certain societies regarded as middle-income countries are behavioural attitudes more than maternal education.

Despite this array of literature on child mortality levels and determinants done worldwide, there is more that can be researched on regarding the determinants of child mortality in Africa. Zimbabwe in particular presents an excellent opportunity to re-examine child mortality determinants considering that the country in recent years battled with one of the worst economic situations in the sub-Saharan region and the generalized HIV pandemic. According to Ensor et al. (2010) economic recessions are known to affect the State's ability to protect its citizens through non provision of pensions and unemployment benefit schemes that function as a buffer to the less privileged of any society. Furthermore, although Zimbabwe is still a developing nation, the level of education is very high, the ZDHS of 1999 reports that women with a level of primary education was 73% yet child mortality is still very high compared to other African countries with low levels of maternal education (CSO and MacroInternational.Inc., 2000). This validates what is highlighted by Hobcraft (1993) that in some parts of sub-Saharan Africa region there was evidence of negative correlation between maternal education and child mortality. The underlying determinants are socially, economically, culturally constructed beliefs and broader context issues that impact on the health outcomes of any society. They include socio-economic status, political, institutional, cultural and broader context issues (Das Gupta, 1990). This section is presents the demographic and proximal determinants of child mortality as noted by other researchers.

A literature search related to Zimbabwe yielded a few papers done exclusively for the country. One such study is a recent study by Kembo and Van Ginneken (2009) that was conducted using data from ZDHS 2005-2006 that investigated maternal education, socio-economic and sanitary variables as determinants of childhood mortality. The study found out that "births of order 6+ with a short preceding interval had the highest risk of infant mortality and that infant mortality risk associated with multiple births was 2.08 times higher relative to singleton births" (Kembo and Van Ginneken, 2009)(p367). They also found out that socio-economic variables impacted less on infant mortality but had significant impact on older children above the infancy stage. Another important factor was the age of mother at the time of birth where infants born to either very young mothers or older mothers had higher chances of dying compared to those born to mothers in the middle ages (Kembo and Van Ginneken, 2009). Marindo and Hill (1997) had conducted a similar study using data from the ZDHS 1988 to investigate determinants of

childhood mortality in the country. The study noted that there were mortality differentials by regions and some of the poorer provinces presented better chances of survival for children under the age of 5.

In another study conducted in Manicaland province, eastern Zimbabwe, which sought to estimate child mortality levels in the context of high HIV prevalence (Hallett et al., 2010) found differentials by HIV status. The study noted high levels of HIV-related child mortality among HIV positive children compared to children who were HIV negative. The results confirmed that HIV positive children had higher chances of dying than HIV negative children. According to Hanmer et al. (2003), rate of child mortality is one of the variables that should indicate a country's developmental stage and needs. Information on infant and child mortality at provincial level is equally good and useful when implementing health programmes and policies such as universal access to Anti-retroviral treatment (ART) for both prevention of mother to child transmission and children living with HIV/AIDS and immunization programmes (Kurewa et al., 2009). In these times of global recession this information is useful to both government and donor agencies in allocation of scarce resources to different provinces of the country according to needs. According to UNDP (2010), in 2009 there were 21,000 children below the age of 15 receiving ART in Zimbabwe. With greater numbers of HIV positive mothers expected to be enrolled into Prevention of Mother to Child Transmission (PMTCT) programmes and more HIV-infected children into ART, child mortality due to HIV/AIDS could decline significantly. This decline may however be compromised where little improvement occurs in other areas of health.

Many studies that have looked at child mortality levels and determinants worldwide (Black, 1984, Mosley and Chen, 1984, Trussell and Pebley, 1984, Hobcraft et al., 1985, Yaukey et al., 2001, Caldwell, 1986, Hill and David, 1988, Ahmad et al., 2000, Breman et al., 2001, Walker et al., 2002, Black et al., 2003, Lawn et al., 2005, Bangha and Simelane, 2007, Mathers et al., 2009, Gakidou et al., 2010, Kaldewei and Pitterle, 2011, Murray et al., 2012, Muhuri and Preston, 1991). These studies have noted varied determinants of child mortality and presented below are some of the determinants that have been noted by several researchers.

2.4.1. Age of mother at birth as a determinant of child mortality

Age of mother at birth is one determinant of child mortality which has received attention from several researchers and results seem to indicate that age of mother at birth is equally important to child survival. For example Hobcraft et al. (1984) and Kembo and Van Ginneken (2009) found out that children born to teenage mothers, especially second born children had, at infant stage a mortality disadvantage when compared to children born to older woman. This may be explained by the fact that teenage mothers lack the maturity and experience to look after children, and are still developing psychologically and emotionally and thus unable to provide the attention required by children at early stages (Philliber and Graham, 1981).

In a study that was conducted by Rothenberg and Varga (1981) in the United States of America, it was found that although there was no significant difference on the health and developmental status at birth of children born to teenage mothers to those born to older women. Children born to teenage mothers however were prone to injuries and life threatening accidents such as burns than those born to older women (Rothenberg and Varga, 1981). Other studies that have examined the relationship between a teenage mother and her child have found that teenage mothers are not able to adjust to motherhood thereby that bound between mother and child is lacking from birth and there is also lack of parenting skills that are important for child survival (Philliber and Graham, 1981). In another study by Tamrat and Kachnowski (2012) it was found that besides having special social and medical needs, teenage mothers are less likely to use pre-natal care than older mothers, thereby exposing their health and health of their babies to risks. Trussell and Pebley (1984) also highlight that certain characteristics of reproductive behaviours are likely to determine the health outcomes of children, for example age of mother at first birth.

It has also been noted that children born to very old women are likely to die before the age of five. In a study that was done by Sathar (1985) it was noted that neo-natal mortality is higher in children born to either very young mothers or very old mothers. Kandala et al. (2006) describes the relationship that exists between child mortality and age of mother as U shaped, where children born to either very young or very old mothers are at similar risk of mortality. In the African context where reproductive career starts at a very young age and births are close to each other, can this be an explanation of why the region has high child mortality compared to other regions?

2.4.2. Child's gender as a determinant of mortality.

Hill and Upchurch (1995); (Hill and Upchurch, 1995, Arnold et al., 1998) tackled the issue of child mortality by gender and argued that in some societies there is female child mortality disadvantage especially in societies where male children are a preferred gender. In these societies where girls are seen as a burden and boys as a valuable resource, there is likely to be an unabated rate of child mortality especially among girls. Furthermore (Basu, 1989, Muhuri and Preston, 1991) suggest that in some instances, high female mortality witnessed in childhood is not due biological factors but to neglect of female children in favour of male children. The inclusion of this factor for investigation was facilitated by the fact that, male gender preferences have been noted in scarce resource situations when parents choose to save the male child at the expense of the female child (Ware, 1984).

2.4.3. Birth spacing as a determinant of child mortality

Black et al. (2003) admit that birth spacing is yet another important determinant of childhood mortality and as such should be accorded similar attention by researchers and by policy implementers. Maternal depletion syndrome, premature or involuntary weaning and sibling rivalry are the known pathways to increased risk of child mortality which needs to be investigated in resource constrained societies that have high fertility as well (Whitworth and Stephenson, 2002). According to various authors (Forste, 1994, Whitworth and Stephenson, 2002, Manda, 1999), there is evidence to suggest that there is a negative relationship between short birth spacing and child survival especially in resource constrained settings, where children compete for maternal care and scarce resources. The authors note that the negative relationship between short birth spacing, sibling rivalry and child survival is more evident for children under the age of two and there is. Sibling rivalry is likely to affect the elder siblings more than the subsequent births as noted by Manda (1999). According to the same author, children who are weaned early because the mother is pregnant have high chances of developing malnutrition, thereby at a much higher risk of mortality. An earlier study (Hobcraft et al., 1985) also found a similar pattern among index children who have siblings born within the following two years even controlling for other factors such as education and age of mother. The risk of dying was even greater in the neo-natal stage with a 50% chance of dying (Hobcraft et al., 1985). They concluded that when there is a gap of less than two years between births, the index child is likely to die before reaching the age of five especially those born to teenage mothers due to the fact that children will be competing for maternal care and resources.

Furthermore, Forste (1994) and Whitworth and Stephenson (2002) describes maternal depletion syndrome as a situation where the mother's 'reproductive and nutritional' nature have potential to wear down due births that are close together. According to Whitworth and Stephenson (2002) the mother's 'reproductive and nutritional' nature is left weakened such that subsequent births are likely to be weak and vulnerable to mortality. This was in agreement with earlier studies (Trussell and Pebley, 1984) who highlight that certain characteristics of reproductive behaviour are likely to determine the health outcome of children, for example child spacing which have been linked to overall child survival. In their study they explored the relation between changes in reproductive behaviour and fertility and subsequent changes in infant and child mortality. They argue that when fertility behaviour is altered either through introduction of family planning programs or delayed reproductive career there is a notable improvement in child health outcomes and the opposite is true in the absence of family planning programs resulting in early or late unplanned pregnancies and births close together.

Manda (1999) quoting Pebley and Stupp, shares the same sentiment and further suggests that births that are close together have potential to wear down the 'reproductive and nutritional' nature of the mother and that result in untimely births and weakened births that have higher chances of not making it to the age of five. Cleland and Sathar (1984) also agree with the findings and suggest that the length of the preceding interval between live births is an essential determinant of child mortality and it can affect those living in rural areas as well as those living in urban areas, whether the educated and the uneducated and both sexes.

2.4.4. Maternal Education as a determinant of child mortality

Maternal education is one determinant of childhood mortality which has received considerable attention from several researchers as they tried to ascertain the causes of childhood mortality especially in different parts of the world and in developing countries in particular (Black, 1984, Black et al., 2003, Trussell and Pebley, 1984, Tekce and Shorter, 1984, Hobcraft et al., 1985, Yaukey et al., 2001, Caldwell, 1986, Caldwell, 1990, Caldwell, 1992, Hill and David, 1988, Hill and Pebley, 1989, Das Gupta, 1990, Ahmad et al., 2000, Breman et al., 2001, Walker et al., 2002, Ward and Zaba, 2008, Muhuri and Preston, 1991). On many instances, the role of maternal education on overall child health outcomes has been thoroughly investigated. One of the researchers who is credited for bringing this issue to the fore is Caldwell, who almost single handed brought to attention this relationship in his pioneer studies in Nigeria. In a paper on Nigeria, Caldwell (1979) points out the importance of women's education on the health

outcomes of children. According to Caldwell, even when controlling for other factors that might be considered important for child survival such as paternal education and socio-economic status of the father, maternal education still remains the primary determinant of mortality for children under the age of five (Caldwell, 1979).

Other studies followed suit and results from these earlier studies seem to maintain that there is a strong relationship between maternal education and child health outcomes (Caldwell, 1986, Caldwell, 1992, Ware, 1984, Cleland and Van Ginneken, 1988, Gakidou et al., 2010, Hobcraft, 1993). According to Caldwell (1979) and Hobcraft (1993) maternal education plays an important role in the survival of young children hence it is generally a determinant of low mortality in societies of low socioeconomic status. Caldwell's arguments are that a mother with a level of education is able to make judgements that are beneficial to the child including when to seek medical care and hygienic practices. He further reiterates that any level of maternal education is good enough to avert deaths in children (Caldwell, 1979). This was further confirmed by Basu and Stephenson (2005), when they found out that even low levels of maternal education had a positive impact on most childhood mortality except for neonatal mortality and management of diarrhoeal diseases. Such judgements as knowing when to seek help from health personnel, knowledge on how to quickly deal with common but potentially fatal childhood ailments such as diarrhoea and accessing health services to improve health outcomes of the children (Rutherford et al., 2010). These several 'pathways' emanates from the fact that a mother has received some form of education. Hobcraft (1993) indicates that his earlier studies seem to concur with Caldwell's findings.

In a recent study that was carried out by Gakidou et al. (2010) using data from 179 countries most of them from developing regions, it was confirmed that in countries where there was an increase in the number of schooling years for women of reproductive years, there was also a significant drop in the rate of child mortality. The study found out that a year's increment on maternal education had the ability to reduce infant and child mortality by between 7 to 9% and "child mortality rates among mothers with at least 7 years of schooling were 58% lower than among those without any education" (Gakidou et al., 2010)(p959). Furthermore, Desai and Alva (1998) (p71) suggest that maternal education may act as a 'proxy for the socioeconomic status of the households'. This is expanded further Cleland et al. (1992) and (Cleland and Van Ginneken, 1988) who point out that this is the case because education in general and most importantly maternal education increases economic recompense for the family, thereby in a position to access such things as safe drinking water, improved housing quality and other things

that improve the general health of children hence improved mortality rates among households with mothers with an education.

Mazambani et al. (2012) seem to agree with this positive relationship between maternal education and the general welfare of children. They further point out that even before the child is born, maternal education plays a vital role as expecting mothers with a level of education are likely to seek ante-natal care, thereby increasing chances of giving birth to health children who live beyond the age of 5 as 40% of deaths occur within the first month of life (UNICEF et al., 2010) from pre-existing conditions. Neo-natal deaths are likely to be averted if pre-existing maternal conditions are addressed early. Some researchers like Cleland (1989) also argue that maternal education is even informative on health seeking behaviour and use of health services. They point out that although the use of health services depend on supply and demand, the use of services goes back to the issue of maternal education, as mothers with an education are more likely to seek medical attention that those without for their own sake or for their children's (Kembo and Van Ginneken, 2009). More-so educated mothers are likely to 'use modern medical facilities' to the advantage of their families (Cleland, 1989). Moreover it has been noted that women with an education are likely to use family planning methods, thereby spacing births which works positively especially for index child. The issue of birth spacing as a determinant of child mortality will be addressed further in this chapter.

Although there is overwhelming evidence that support the existence of positive correlation between maternal education and child survival, it is also imperative at this point to note other studies that have questioned this relationship. For example Caldwell (1986) and Ware (1984) have questioned the relationship between child survival and maternal education. Both authors have interrogated the intensity of the relationship in some societies and have indicated that there are certain societies that have shown a weak connection (Caldwell, 1986, Ware, 1984). Furthermore Cleland et al. (1992) and Hobcraft (1993) point out that it is time to reflect on current education attainment levels by women and question if maternal education still holds ground in instances where majority of women have an education. Cleland et al. (1992) acknowledge that today's mothers are likely to have an education compared to mothers in the past. Ware (1984) interrogates the issue of maternal education further and states that maternal education in the developing world was effective during colonial era when only a few women had an education. The current status quo is that education is almost universal even in the developing regions yet these regions continue to register child mortality rates that are way above other regions. As a result of these questions on the role of maternal education, many

researchers have started to openly acknowledge that other determinants of child mortality are equally at play in determining child survival. For example Caldwell (1986), notes that factors such as religion exert greater influence on child morbidity and mortality. He notes that in religions such as Islam child mortality is higher compared to other religions.

There is urgency to re-examine maternal education as the most important determinant of child mortality considering that the number of females enrolled for primary education continues to increase each year and more and more women are finishing secondary education. In Zimbabwe, the percentage of female children enrolled for primary education has continued to rise and in some years the percentage is greater than male children enrolment (UNICEF, 2008) but the rate of child mortality decline is somewhat at a very slow pace to match overall maternal education. Despite all these findings that have pointed to the importance of maternal education towards child survival it is nevertheless important to ask ourselves now this vital question which is; is maternal education still as relevant as it was two to three decades ago in the African context considering positive things such as increased access to education by women and negative factors such as conflict, HIV/AIDS pandemic and economic challenges that are faced by the continent?

2.4.5. Household economic status as a determinant of child mortality

Family household income as a determinant of child mortality has been described by Casterline et al. (1989) as one of the most difficult determinants to measure partly because unlike demographic determinants of child mortality that can be easily manipulated from survey data, household income is not. Another reason cited by Casterline et al. (1989) as contributing to the under-researching of household income as a determinant of child mortality is the fact that many studies over the years have found it to have no impact on child survival, hence many researchers have abandoned or simply ignored this important determinant of child survival. However a recent study by Pongou et al. (2006) found that household socio-economic status had a positive impact on child survival during the economic crisis in Cameroon.

Tekce and Shorter (1984) (p263) define household income as "a measure of the current flow of economic resources to the family". As Casterline et al. (1989) note, it is one determinant of child mortality which is usually neglected because it is difficult to assess the direct effects of income on mortality using survey data, since in most instances variables that are linked to income such as dwelling type, household water and toilet facilities are assessed instead. This

determinant is important to investigate especially in societies such as Zimbabwe where there is inequality; resources not equally distributed and are going through economic turbulence. Higher household income is associated with ability to purchase health services and other necessities such as nutritious food for the better health of the children. In a seminar report by Hill and David (1988) it was noted that food consumption is strongly influenced by income. However in the same seminar report by it is suggested that food consumption is not entirely dependent on nutritional value only but by taste and appearance of the food such that in some households where income is high, nutrition is poor and vice versa.

The type of dwelling is also largely determined by the amount of income that flows to the household. In the long run dwelling type can either pose health hazards to the occupants or promote health more-so to very young children. In their study Tekce and Shorter (1984) put dwelling types in three groups, namely first, second, and third classes, and they found differences in child mortality by class of dwelling.

2.4.6. Country/Community level health care system as a determinant of child mortality

Some researchers have argued that the issue of health care system goes in both directions, that is, the providers of health services on one hand and the consumers of that service on the other hand (Aday and Andersen, 1974, Ensor and Cooper, 2004). In some instances services are lacking but there are people willing to use such services and in some instances services are available but people are not willing to use the available services for some reason or the other. According to Ensor and Cooper (2004) barriers to accessing health care services are more pronounced in poor countries because of high costs and efforts associated with accessing health and also other dominant forces such as cultural and religious beliefs. Aday and Andersen (1974), argue that the word 'access' should not imply only the financial capabilities to pay for services or availability of health care resources in an area. The word 'access' should be looked from both sides and there should be some efforts to try to identify from both sides the factors that are blocking 'access'. Some researchers such as Ensor and Cooper (2004) seem to agree on the importance of the type of health care service providers in attracting people to use their facilities. People might choose not to use a particular health service provider for many reasons, including lack of empathy by staff towards their clients and confidentiality issues. According to Ensor and Cooper (2004) for service delivery to be accessed and accepted it should encompass refining of staff skills, adherence to treatment protocols, easy access to supplies and have an environment that is favourable to those seeking medical care. This is very true in the

context of such diseases that have a stigma attached to it for example HIV/AIDS and diarrhoeal diseases. Mothers might shun going to certain clinics and hospitals because there is no privacy accorded to each patient and they are scolded in front of other patients, that alone can make a mother delay going to a service provider either for immunization purposes or seeking treatment despite knowing the consequence of such a move.

A situational analysis for Zimbabwe that was done by UNICEF et al. (2011a) acknowledges that during the time when the country was facing many economic challenges, the health delivery system collapsed together with the other essential services such as the education system. During this time it was pointless to visit the public hospitals and clinics for services as there were chances of not getting the required services as public hospitals and clinics ran out of essential drugs and personnel. Since most poor people depend on these vital services provided by the government, it translates that many people were left vulnerable as a result of the economic challenges. In the scenario described on this section it is most likely that health care system itself can be a determinant of child mortality.

2.4.7. Area of residence whether urban or rural as a determinant of child mortality

Data from the 5 ZDHS (1988, 1994, 1999, 2005 & 2010-2011) indicate that there are child mortality variations between urban and rural areas (CSO and Macro-International.Inc, 2007, CSO and IRD/MacroSystems.Inc, 1989, CSO and MacroInternational.Inc., 2000, CSO and Macro-International.Inc., 1995, ZIMSTAT and ICF-International, 2012). For example the ZDHS of 1999 found that both IMR and U5MR were high in rural areas compared to urban areas with IMR of 47.2 per 1000 live births for urban and 65.3 per 1000 live births for rural areas and U5MR of 69.0 per 1000 live births for urban and 99.7 per 1000 live births for rural areas (CSO and MacroInternational.Inc., 2000) This scenario of having higher mortality burden in rural areas compared to urban areas has been attributed to many factors that include high levels of maternal education in urban areas than rural areas, huge economic disparities between rural and urban settings, with urban settings having economic advantage over rural settings and resource allocation (Sastry, 1996). In a study that used data from DHS for 62 developing nations from Africa, Asia, Europe and Latin America it was found that area of residence has an important role to play in determining mortality of children under the age of five (Wang, 2003). Results from all the countries involved in the study revealed that child mortality was higher in rural areas than in urban areas except for one or two countries. Again the main reason

cited was the fact of resource allocation between rural and urban areas. While in urban areas health provision services are within accessible proximity the same cannot be said for rural areas where parents and caregivers have to travel long distances to access health services. This also means extra costs for parents to go to health providers. According to Rutherford et al. (2010), policy implementers and planners should consider seriously the issue of distance and costs associated with health seeking as a barrier to accessing health care services especially in sub-Saharan Africa in efforts to reduce child mortality. More over people in the rural areas have to deal with transportation and communication issues to and from health provision services, a privilege most urban areas have (Ensor and Cooper, 2004). In most of the developing countries medical personnel is crowded in urban areas leaving rural children at the mess of inexperienced and in most instances overwhelmed personnel.

Availability of electricity at a larger scale in urban areas is another factor that has been identified as contributing to better health outcomes for children in the urban settings compared to those in rural areas (Wang, 2003, Wichmann and Voyi, 2006). In urban areas where there is electricity and families use electricity for cooking, young children are less exposed to harmful gases that might be a source of lung diseases. A study that was conducted by Wichmann and Voyi (2006) in South Africa among children between 1-59 months confirmed that children who live in households that depend on wood, cow dung, paraffin and others fuels that produce harmful gases had higher chances of suffering from fatal lung conditions. All these factors in the long run serve as a disadvantage to children residing in rural areas in comparison to those residing in urban areas.

However, Black et al. (2003) note that although most child deaths in developing countries occur in rural areas, children who reside in urban slum areas are at the same risk of dying as those in rural areas.

2.4.8. Environmental, community socio-economic status and other social factors as determinants of child mortality.

Environmental and community socio-economic situations are regarded as distal proximate determinants of child mortality as they have an indirect effect on mortality. The view that children born in poor environments and socio-economic settings have mortality disadvantage

is emphasised by researchers such as Black et al. (2003) and Wang (2003). Black et al. (2003)(p2227) citing Ezzati, et.al relate how poor environments and community socio-economic status can have a negative impact on child survival, highlighting that "ingestion of unsafe water, inadequate availability of water for hygiene, and lack of access to sanitation contribute to about 1.5 million child deaths and around 88% of deaths from diarrhoea". Environmental factors also include the climatic conditions of any society, "access to clean environmental conditions at the community level" and household characteristics (Pongou et al., 2006, Sastry, 1996). Pongou et al. (2006) further point to how waste disposal in a community can work as a catalyst for transmission of diseases that are a threat to child survival, including malaria and diarrhoea. Root (2001) further validates this making reference to poor communities that lack the necessary resources required to avert the death of small children. The researchers' study in Zimbabwe found a pattern of higher rates of diarrhoeal diseases among children living in poorest communities that lacked clean sources of drinking water compared to those with protected sources of drinking water. In low socio-economic nations, lack of resources accompanied by distinctive low levels of education among women heighten the chances of unawareness among women to know the methods of purifying water in the absence of safe drinking sources of water. Black (1984) notes that 'exposure and response' to diseases is to a large extent influenced by socioeconomic status and the environment in which these diseases are occurring. Furthermore, Ensor et al. (2010) suggests that health care spending is mostly the responsibility of governments through its capacity to collect taxes and distributing money to various departments of the government. It has been noted that if a government is unable to collect taxes because its citizens are poor this translates to poor service delivery can have an impact on the most vulnerable in this case on child survival (Ensor et al., 2010). Wang (2003) notes that the current child mortality gap between the developed and developing nations is a clear testimony that environmental and socio-economic status of a nation or community will subsequently have a bearing on child mortality levels.

Eradication of extreme poverty is an equally important MDG goal and in-fact it is the first goal on the list of the 8 goals agreed upon by the international community and as Gwatkin (2005) points out, it is very difficult if not impossible to address the other developmental issues before dealing with the first goal. Issues of child mortality and poverty eradication are thus inseparable. According to Ensor et al. (2010) the economic shocks that are a result of economic recessions have a huge impact on service delivery especially for developing countries than the developed countries. For that reason it becomes an urgent issue to address the core issue of

poverty before addressing such issues as child mortality. Health services and programs that are meant to significantly reduce either adult or child mortality is affected directly or indirectly by lack of enough funds and resources. Nutrition which also plays an important role in fighting against diseases is lacking in families and societies that depend on less than a dollar a day for survival (UNICEF et al., 2011a). It was also noted that environmental changes and climate changes impact heavily on poor nations and communities as these have no advanced technology to protect themselves against harsh weather patterns brought about by climate change (Homer-Dixon, 1991)

2.4.9. Cultural and religious beliefs as determinants of child survival

Cultural and religious beliefs have a potential to shape one's behaviour and receptive towards information and subsequent use of that information, including health information. Hostetler (1993) in Gregson et al. (1999) note that marginal groupings by culture or religion have a tendency of diverge from what is regarded as the 'norm' and this could affect their behaviours including health seeking behaviours. In cultures that still believe in traditional ways of treating sicknesses, modern ways of treating diseases are considered inferior. No the other hand, religion might forbid its followers from seeking medical care, preferring to deal with sickness their religious way. Results from a study that was conducted by Gregson et al. (1999) in Zimbabwe indicates that religion has an important role to play in the way people make use of health services. The authors note mortality and fertility differentials among people who followed different religious and cultural beliefs and acknowledge the role played by both culture and religion in shaping behaviour. Moreover, Caldwell (1990) also notes that child mortality patterns can be affected by ethnic or cultural beliefs hence a society or country can experience different mortality patterns regardless of similar health services mainly due cultural or religious beliefs dominant in each region. Zimbabwe is one of the countries in the sub-Saharan Africa with a high percentage of female adult literacy which is estimated to be 94 per cent yet child mortality and infant mortality rates have been somewhat fluctuating between 1990 and 2010 suggesting other factors as determinants of child survival.

2.4.10. Spatial distribution as a determinant of child survival

A few studies have looked in-depth on the issue of spatial distribution and how it determines child mortality. As noted by Kandala et al. (2006) it is important to identify regional child

mortality variations for policy implementation purposes and intervention purposes as mortality is likely to be associated with geographical location. In a study conducted by the authors in Malawi they found that prevalence rates of diseases such as malaria and diarrhoea were different from one area to the other. Another study by Root (1997) yielded similar results in different provinces of Zimbabwe when it was observed that child mortality is not uniform in all the provinces of Zimbabwe, as mortality differentials are affected by population density among other determinants. He notes that children residing in the provinces that are regarded as "Ndebele" provinces of Zimbabwe (because the population is predominantly Ndebele speaking) have mortality advantage compared to children in the provinces that are regarded as "Shona" provinces (predominantly Shona speaking provinces). This is despite the fact that the "Ndebele" provinces are by far less privileged in terms of health services in the areas than "Shona" provinces in the country. The study hypothesised that this mortality advantage was likely attributed to the provincial population densities. While the "Shona" provinces are more populated, the "Ndebele" provinces are less populated making it difficult for diseases such as diarrhoeal conditions that are deadly to children under the age of five to spread faster. Another study that was conducted by Bangha and Simelane (2007) in South Africa found similar trends of differentials in child mortality among different provinces in the country. In the study the 9 provinces were further divided in Magisterial Districts (MDs) and a total of 354 MDs were identified. The study found that at the provincial level there were notable mortality differentials in MDs. For example in the Eastern Cape huge mortality disparities were noted in MDs such as Tabankulu, Lusikisiki, Bizana, Flagstaff, Libode (Bangha and Simelane, 2007).

2.5. Literature Gap

All the studies mentioned above identified important determinants of child mortality in developing and middle-income countries but none identified determinants of child mortality in the context of an economic crisis. Can the usual determinants of child mortality such as maternal education that have been identified by many researchers remain true in the context of an economic predicament? There is need to re-look at the determinants of child mortality and come up with new literature on this topic taking into consideration that the world is currently battling a global economic recession. In this recession developing countries are likely to be affected the most as funders and government spending on economic activities are affected to the detrimental of programs that are meant to improve child outcomes.

2.6. Conceptual framework(s)

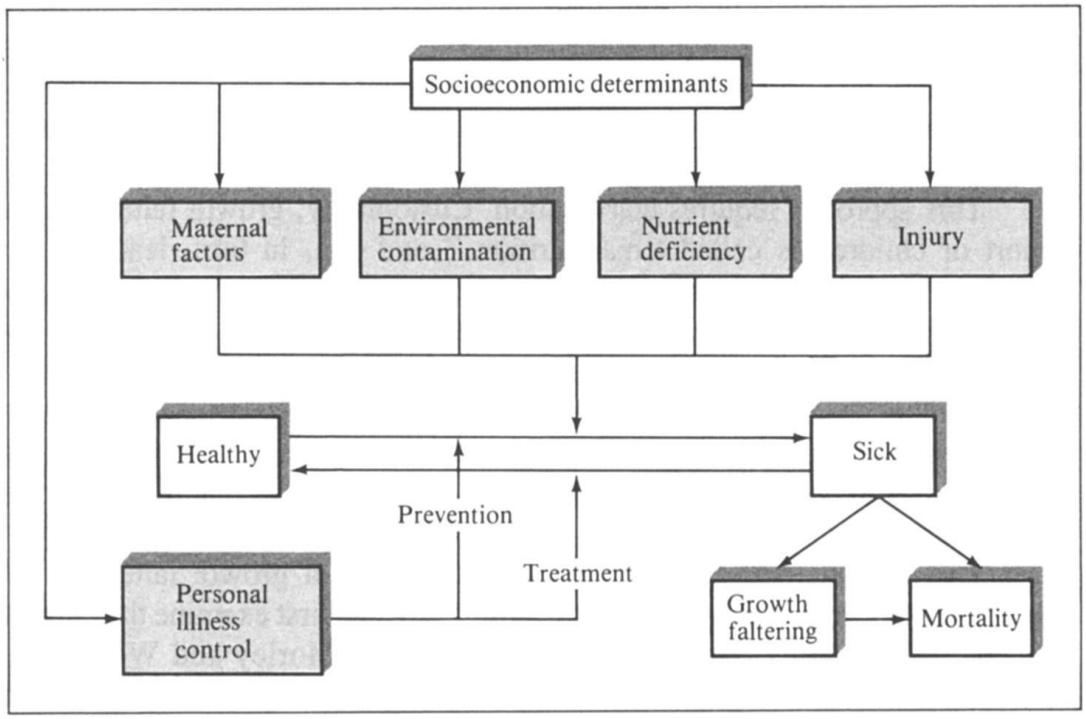
The study was guided by two theoretical frameworks that blend very well to explain fertility and mortality patterns, that is the Demographic Transition Theory (DTT) and the proximate determinants framework as proposed by Mosley and Chen (1984). The DTT was first formulated by Thompson in 1929 when the author put countries in three major groups depending on rates of fertility and mortality experienced by those countries. Countries in the first group were those with declining population growth due to falling fertility and mortality rates. Countries belonging to this group have a stationary population first before they experience a declining population (UNICEF et al., 2011b). The second group of countries are those countries where there is both decline in fertility and mortality but mortality rates decline at an accelerated rate than the birth rates resulting in a faster growing population. This does not last forever nevertheless, eventually births rates fall at the same pace as mortality rates, bringing about a stationary population and consequently a declining population (UNICEF et al., 2011b). The last group of countries consists of countries where there is no sign or minimum decline of fertility and mortality and according to Thompson in (UNICEF et al., 2011b) majority of developing countries belong to this group. Caldwell (1976) regards these countries as 'traditional societies' and the DTT argues that in these 'traditional societies' fertility is high so is mortality partly due to lack of technological advancement, lack of individual advancement and the economic value placed in children.

However, as societies progresses towards 'civilization' the focus shifts towards development, self-actualization, individualism and the 'erosion of traditional family' forces people to change their perceptions on the need to have more children as a copying mechanism to the loss of children (Caldwell, 1976) (p324). When this shift occurs there is a notable decline in fertility first as women take other responsibilities such as education and employment other than the rearing of children. This decline in fertility will eventually lead to a decline in mortality as women pay more attention to the few children they have and make use of technology to avert deaths of their children. According to UNICEF et al. (2011b) this transition is not an overnight transition, but it is a process that takes time and can take between three to four decades for a country to transit from one group to the next.

On the other hand the proximate determinants framework assumes that child survival is influenced by various circumstances including social, economic, biological, maternal education and environmental factors (Hobcraft, 1993). It was with this in mind that the study

sought to outline child mortality levels, and determinants for the 10 provinces of Zimbabwe. According to Mosley and Chen (1984)(p141) a set of proximate determinants are evident in the subsequent child mortality reduction in any society. They can be easily grouped into five categories and they are a) maternal factors for example age of mother, parity and birth interval b) Environmental contamination c) nutrient deficiency d) injury e)personal illness control. Since the purpose of this study was far more than counting numbers, understanding of these determinants to child mortality would inform policymakers and measure milestones but most importantly to look at child mortality as "a chronic disease process with multi-factorial origins" Mosley and Chen (1984)(p144). The proximate determinants framework is best summarised by figure 2.3 which shows the relationship between mortality and determinants.

Figure 2.3: Mosley and Chen's framework of determinants of childhood mortality



Taken from Mosley & Chen (1984)

Figure 2.3 shows that there are several socioeconomic factors that facilitate child health and mortality.

Maternal factors such as level of education of the mother and birth spacing can have a direct impact on the wellbeing of a child. The same applies to all the other determinants that are highlighted in figure 2.3. On the other hand prevention and treatment of diseases result in healthy children and non-prevention and non-treatment of diseases results in sickness which affects growth and may likely result in mortality.

2.7 Chapter conclusion

This chapter took a closer look at the literature related to child mortality levels on the global, sub-Saharan Africa and also the Zimbabwean contexts. The trend suggests child mortality has been declining globally but in some countries in sub-Saharan Africa the progress towards global targets has been slower pace than previously anticipated. Furthermore this chapter looked at some studies that were done globally and in Zimbabwe that identified various determinants of child mortality in developing and middle-income countries. From the various determinants of child mortality that were discussed in this chapter it was apparent that each context presents an opportunity to learn about determinants that are more relevant to that context. Challenges that are hindering progress towards achieving MDG number 4 was also touched on albeit briefly.

Chapter 3 Methodology

3.0 Introduction of the chapter

Chapter 3 presents the methodology for the study. The objectives of the study were to establish determinants of childhood mortality in Zimbabwe for the period 2006 to 2010 using the most recent Zimbabwe Demographic Survey (ZDHS) 2010-2011). The first part of this chapter describes the research methodology, study design, followed by a description of the data sources used for the study. Also presented here are the sampling methods including the study instrument used for the ZDHS of 2010-2011. A description of the dependent variable which is childhood mortality and independent variables that influence child mortality are also covered in this chapter. Statistical methods used for this study are also presented on this chapter. The chapter ends with the conclusion section.

The dependent variable which is childhood mortality is measured against the well-known and well established independent variables that include demographic parameters such as age of mother at birth and child's gender. Besides these demographic parameters, the effects of distal determinants and socio-economic factors such as maternal education, household socio-economic status, area of residence whether rural or urban and province of residence.

3.1. Study Design

The study is a quantitative research design, which allows us to put numerical values to social observable issues (Basu, 1989). Antonius (2002) justifies the quantifying of occurrences in social sciences as necessary if we want to observe numerical changes, for example population changes. The author also mentions that it is possible to describe occurrences accurately and to establish links between issues or variables being investigated in this case the relationship between childhood mortality and age of mother, child's gender, maternal education, areas of residence, household wealth status and province of residence not necessarily in that order. By nature the Demographic and Health Surveys (DHS) are descriptive surveys that generate cross-sectional data which allows us to deduce certain characteristics about the entire population. Vogt (1993)(p67) defines descriptive research as "research that describes phenomena as they exist". Williams (2003) further acknowledges that although the design of descriptive surveys is simple by nature, the surveys have the capacity to collect as much information as possible about the study population. The writer further suggest that descriptive surveys make it possible to describe populations over time and also to make inter-country comparisons with countries

that have conducted similar studies (Williams, 2003). One advantage of descriptive surveys identified by Williams (2003) is that it is economically viable in the long run as there is no need to conduct several studies about different variables of interest.

Nevertheless it is also necessary to acknowledge disadvantages of descriptive surveys as noted by Welman et al. (2005). The authors note that descriptive surveys suffer from threats to internal validity. They note that in usual scenario the respondents may have large variations in such variables as age and this introduces bias when generalizing findings as different ages have different needs. An added challenge concerns making sure age groups included in the survey are representative of population age groups (Welman et al., 2005).

Cross-sectional data captured by descriptive studies such as DHS makes it possible for researchers to study many phenomena such as mortality, fertility, migration and general behaviours of the population being investigated. This makes descriptive research the most appropriate method to use for this kind of study, since mortality data is captured in detail in this research method. In the ZDHS 2010-2011, women were asked to provide a detailed account of birth history capturing children ever born and the number that has died and the exact date of the event.

DHS make use of questionnaires to get the necessary information from the respondents. Several questions related to fertility, mortality, household characteristics, socio-economic status, nutritional status and behaviours are answered by those who take part in the survey. The ZDHS 2010-2011 had three questionnaires, one was for men, and the other one was for women and the household questionnaire. This study uses only answers provided by women on reproductive issues in-order to estimate childhood mortality and determinants, hence the use of data generated from the women's questionnaire. Some of the questions that women were asked include the following:

Q 201. Now I would like to ask about all the births you have had during your life. Have you ever given birth?

Q 206. Have you ever given birth to a boy or girl who was born alive but later died?

3.2. Description of Data source

This study is embedded in cross-sectional data emanating from The ZDHS conducted in 2010-2011. According to De Vaus (2001), the DHS provide answers to some of the questions such as how many people have particular characteristics and how many have experience certain events such as mortality. DHS provides information on the three components of demographic changes especially for developing countries. The DHS usually have a large sample size and this improves confidence interval of the studies and reduces the chances of making Type 11 (β) error of reporting a false negative result based on a small sample size (Bryman and Cramer, 1990). Surveys such as DHS and World Fertility Surveys have become a source of reliable data especially for developing countries as they produce cross-sectional data making it possible to understand health and social issues on populations being studied. The DHS are financially and technically supported by US Agency for International Development (USAID) and Macro International. In Zimbabwe the surveys are conducted in partnership with the Zimbabwe National Statistics Agency (ZIMSTAT formerly Central Statistical Office) a governmental department which is responsible for producing and keeping of data related to fertility, mortality, migration and health surveillance. The ZDHS have been conducted in Zimbabwe after every five years since 1988 making the ZDHS 2010-2011 the firth DHS to be conducted in Zimbabwe since 1988. Data from the ZDHS 2010-2011 is stored in different files that are the Birth Recode file, Couples Recode, Household Recode, Individual Recode, Children's Recode, Male Recode and Household Member Recode. For this study, analysis of determinants of childhood mortality is limited to the five year period preceding the survey. The main objectives of the study were to see the impact of well-established determinants in a country facing economic challenges.

3.3. Statistical procedures for data analysis

Data analysis process and data extraction process was intertwined and the study made use of Stata version 11 a statistical computer program that allows for extraction and analysis of relevant data from the dataset. As already highlighted earlier, the ZDHS 2010-2011 data was stored in different formats and in Stata the data was stored in seven files namely the Birth Recode file, Couples Recode, Household Recode, Individual Recode, Children's Recode, Male Recode and Household Member Recode. For the purpose of this study, data for analysis was extracted from the Children's Recode file. The Children's recode file contains status of children

born 48 months ago and did not include other reported births and deaths that occurred 10 to 15 years preceding the 2010-2011 survey.

For this study data was analysed using three methods of analysis. The first phase of analysis involved using descriptive analysis. The second stage involved the use of logistic regression analysis and the third phase of analysis employed survival analysis using the Kaplan-Meier (KM) estimator method to compliment logistic regression analysis. The use of three models for data analysis was necessitated by the fact that the logistic regression and survival analysis complement each other. According to (Glidden et al., 2011)both methods are from the same family of what they termed multi-predictor regression methods. The authors highlight that the multi-predictor regression analysis methods are used to communicate the role of many independent variables to dependent variable and each regression method in this family plays a different role with an aim of achieving diverse outcomes. The authors further acknowledge that although regression models in the family might differ in how they handle statistical data, they all share some similarities allowing researchers to combine one or two models to analyse data fully. For example survival regression analysis and logistic regression analysis can both handle binary outcome variables. In case of this study while survival analysis would measure time to occurrence of an event (childhood mortality between 0-48 months by independent variables), logistic regression analysis would estimate the probability of an event (childhood mortality by independent variables) occurring thereby complementing each other.

Below is a further description of all the methods of analysis that were used for this study.

3.3.1. Descriptive analysis

Descriptive statistics was essential to perform as it provided some insights on the relationship that existed between variables of interest by way of comparing percentages and thus formed a background for later analysis using other methods as noted by Reid (1987). Furthermore, Glidden et al. (2011) argues that descriptive analysis can be used as an exploratory method which can be used by researchers to easily identify irregularities associated with the data under review. Vogt (1993) describes descriptive analysis as a method used to summarize, organise and graph data in a systematic way, making it easier to understand and for comparing subgroups. According to Reid (1987) (p42) the sole purpose for descriptive analysis is to "describe the characteristics of a sample or population in terms of variables". For this study descriptive analysis was performed first and then was put closer to logistic regression analysis

for easy comparisons. Deaths that occurred in infancy (0-11months) and those that occurred from 12 months to 48 months were bundled together and put in one group to form childhood mortality. The second stage also presents the odds of being reported dead for the variables before modelling.

3.3.2. Logistic regression

Logistic regression analysis belongs to a family of multivariate regression methods that are used to establish existing relationships between and among variables. According to (Reid, 1987)measuring of existing relationships or associations between and among variables is important in the field of social statistics as it helps with the formulation of theories and hypotheses. Logistic regression measure association between variables and it is a method which accommodate dependent variables with categorical outcomes (Rutherford et al., 2010). Logistic regression can be used to estimate likelihoods, probabilities, odds and log-odds of an event occurring (Rutherford et al., 2010). For this study logistic regression was used to estimate the odds an event happening and is presented as odds ratios (Rutherford et al., 2010). These odds ratios that are produced with logistic regression analysis tells us the association that is likely to occur with dichotomous outcomes, in case of this study whether the child was still alive or dead at the time of the survey (Newton and Rudestam, 1999). Since the outcome variable was a two-category dependent variable, binary logistic regression was the most appropriate method for this study (Rutherford et al., 2010, Marsh and Elliott, 2008). Where 0 was children alive and children dead were coded 1. (Rutherford et al., 2010) indicates that one advantage of logistic regression is that it can accommodate many independent variables as long as they have dummy coding. Another purpose of the analysis using logistic regression analysis is to assess the effects of multiple explanatory variables on the outcome variable. Logistic method of analysis involves the construction of models or logits that predict the odds of an event occurring (Marsh and Elliott, 2008, Vogt, 1993). For this study the odds ratios are presented. The P values or the levels of significance that are produced by running a logit test for independent variables in Stata, gives an indication of whether the variable is significantly different from 0 (Marsh and Elliott, 2008). Garson (2012) also points out that logistic regression can be useful when predicting a dependent variable and when determining the significance of independent variable on the outcome variable. Most of the study's variables were categorical variables. Goodness-of-fit tests were measured using the likelihood ratio generated in Stata. The equation for predicting the probability of an event occurring using

logistic regression analysis when investigating the effects of one independent variable is as follows

$$\boldsymbol{log\left[\frac{P_i}{1-P_i}\right] = log0_i = \alpha + \beta X}$$

(3.1)

Where 1 is the probability of being alive and P_i is the proportion of dying, $log0_i$ is the odds of an event occurring and $\boldsymbol{\alpha + \beta X}$ is the effects of one independent variable before controlling for other factors

The formula that involves many independent variables therefore becomes

$$\log\left[\frac{P_i}{1-P_i}\right] = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots + \beta_p X_{ip}$$

(3.2)

Where $1 - P_i$ represent the conditional probability of being alive; P_i is the proportion dying and O_i is the conditional odds of being alive and $X_{i1,}\ X_{i2} + \ldots . X_{ip}$ are the effects of independent variables, $\beta_{1,}\ \beta_{2\ldots .}\beta_3$ are the slope coefficients. In order for interpretation of logistic regression using odds, antilogs were applied to equation 3.2 to have the model as;

$$\frac{Pi}{1-Pi} = e^{\alpha+\beta} = e^{\alpha}\left(e^{\beta}\right)^{X}$$

(3.3)

Where the two constants multiplied by each other raised to the power X imply that an additional explanatory variable added on to the regression has a multiplicative effect on the odds of dying.

For this study three models were constructed. The models were labelled model I, II and III. In Model I the study investigated the effects of demographic factors which are age of mother and gender of child. In the second model socio-economic factors that have been known to impact on the survival of children that include maternal education and household socio-economic status are introduced. The third model which is model III introduces geographical variables which are area of residence whether rural or urban and region of residence to the equation. The introduction of variables at different stages has been in existence for a long time now and it is

referred to as the Simpson paradox (Marsh & Elliot, 2008). As already indicated, it is the process of introducing variables at different stages in-order to see the relationship between or among variables (Marsh and Elliott, 2008)

3.3.3. The Kaplan-Meier Estimator

Kaplan-Meier (KM) is one of the methods that is used to measure survival data. Survival analysis can also be referred to as time to event analysis. According to Bewick et al. (2004) (p389), "survival times are data that measure follow up time from a defined starting point to the occurrence of a given event". Survival analysis was used to the estimate timing of dying for the birth cohort and to estimate the survivorship probabilities for the cohort using KM. Kaplan-Meier estimator is a non-parametric estimation procedure which considers both censored and uncensored cases. Cases that are censored are those not yet experienced an event, in the case of this study these are the children that were reported alive in the survey. On the other hand the uncensored cases are the children reported dead. It is important to censor cases, as ignoring censored observations introduces bias to the results. Non-parametric procedures are fitting for first exploratory analyses as they make no assumption about the distribution of events to be analysed (Blossfeld et al., 1989). Nevertheless for this study the KM estimator was used to complement logistic regression analysis by way of graphing the probability of dying for subgroups. Furthermore all except one of the variables of interest were categorical predicators and so graphing KME showed weather the predicators were proportional or not. According to Blossfeld et al. (1989) the KM estimator method of estimating the survival function is more appropriate when dealing with samples that are not very large and have too many variables. The objective was to estimate the survival function S(t) which has been defined by Bewick et al. (2004)(p389) as "the probability of surviving at least to time t". A survival curve can then be presented as a graph which shows the probability of experiencing an event at each time period for all the variables of interest. In this case the probability of cumulative proportion surviving from birth to 48 months for the 2006 to 2010 birth cohort by selected variables of interest was graphed. The equation for KM is presented as

$$S(x) = \prod_{\{y=0,x-1\}d} P_y = \prod_{\{y=0,x-1)}(1 - q_y) \qquad 3.3$$

Where $S(x)$ is the survivor function and $\prod_{\{y=0,x-1\}d} P_y = \prod_{\{y=0,x-1)}(1-q_y)$ are the reduction factors at each stage.

For this study, KM graphs were appropriate to use as the graphs illustrated the probability of mortality at different times in relation to the selected variables. The KM graphs make it possible to make comparisons between subgroups as noted by Blossfeld et al. (1989).

3.4. Dependent variable

Dependent variable has been described by (Welman et al., 2005)(p17) as "that factor which the researcher observes and measures to determine how it was affected by the independent variable". The same authors also indicate that dependent variable varies depending on the effects of the independent variable on it. For this study the dependent variable was status of child whether dead or alive at the time of the survey, indicating that the dependent variable had binary outcome. All the children that were reported alive at the time of the survey and belonged to the 2006-2010 birth cohort were coded 0. The children that were reported dead at the time of the survey and were from births of 2006-2010 were coded 1. Children dead included all the children from infancy to children under the age of 5. The ideal situation is to measure determinants of IMR and U5MR separately as determinants of mortality differ for the two groups, however for this study the cases were bundled together in-order to have enough cases and make conclusions based on a bigger sample size.

3.5. Independent/predictor variables

According to Welman et al. (2005), the independent variable is the factor that can be manipulated by the researcher in-order to observe its effects on the dependent variable. For this study a number of independent variables were of interest and they are indicated below. The independent variables have been put in three groups mainly the demographic factors, socio-economic factors and geographical factors. Most of these determinants were discussed in detail earlier in chapter 2. Presented on this section is a brief discussion on the determinants that were of interest in this study.

3.5.1. Demographic factors (age of mother at birth, child's gender)

Maternal and biological factors presented on this section are only those that were being investigated in this study.

3.5.1.1. Age of mother at birth

Many studies have found maternal age to have a significant influence on child survival. Hobcraft et al. (1984) and (Kembo and Van Ginneken, 2009) have gone further to assess the effects of age of mother at each stage of child's life. In general it has been found that children born to either very young mothers (less than 20 years) or fairly older women (above 35 years) had higher chances of dying before reaching the age of five (Kembo and Van Ginneken, 2009). In the ZDHS, women who participated in the survey were put into 5 year age groups. Women age 15-49 participated in the survey and answered several questions, including issues on fertility, mortality and marital, among other issues. The women were asked several questions as a way of filtering and identifying if the women were eligible to take part in the survey. The questions asked included; (Q.102) In what month and year were you born, (Q.103) How old were you at your last birthday. For birth histories women were asked to provide information on children ever born and children born since 2005 and 1 year ago. This study was only interested in investigating the status of children born 5 years preceding the survey, as a result these are the births that made up the sample. The births and deaths from this cohort were grouped by women's 5 year age groups.

3.5.1.2. Child's gender

The inclusion of this factor for investigation was facilitated by the fact that, male gender preferences have been noted in scarce resource situations when parents choose to save the male child at the expense of the female child (Ware, 1984). In the context of Zimbabwe were patriarchal tendencies are still prevalent it was important to investigate the effects of gender child mortality during the economic crisis. Generally in patriarchal societies childhood mortality has been linked to child's gender where couples prefer male children over female children (Hill and Upchurch, 1995, Arnold et al., 1998). Furthermore (Basu, 1989, Muhuri and Preston, 1991) suggest that in some instances, high female mortality witnessed in childhood is not due to biological factor but to neglect of female children in favour of male children. (G.o.Z and UN, 2010) acknowledges that although a lot has been done to reduce overall childhood mortality, one area which has not received much attention was how gender of child had impacted on the welfare and chances of child survival. Women who participated in the ZDHS

were asked to provide a detailed birth history of all the children ever born including gender of the child and names of those children. After providing information on children ever born, women were probed further by the following questions in-order to provide details on gender of child and mortality: (Q 206). Have you ever given birth to a boy or girl who was born alive but later died? (Q 207.) How many boys have died? How many girls have died?

Q 220. IF DEAD: How old was (NAME) when he/she died? For analysis all the births and deaths for children born between 2006 and 2010 were classified by two gender groups, female for all the children that were reported as girls and male for all the boys.

3.5.2. Socio-economic factors (maternal education, household socio-economic status (HSES))

The ZDHS collect information on socio-economic factors and these include education attainment for the women, education attainment for the head of the household, household toilet facility, source of drinking water, source of energy, ownership of household electrical goods, rooms in the households used for sleeping purposes alone, floor material, ownership of automobiles among other factors all these refer to wealth index. Results of which were then used to estimate and classify households by wealth index. For this study however, maternal education was analysed separately in-order to see its effects on child survival on its own.

3.5.2.1. Maternal education

Different studies have acknowledged the importance of maternal education to overall child survival and some have suggested that mass education of women is likely to contribute significantly to the decrease in the number of children who die before reaching 5 years (Black, 1984, Das Gupta, 1990, Caldwell, 1986). All these studies have found that any level of maternal education was good enough to avert the deaths of children under the age of 5. It remains one of the most important determinants to investigate especially in countries facing economic challenges. In the ZDHS 2010-2011 household members were asked to provide level of education of all members of the household before selection of one eligible woman respondent from the household to answer ensuing questions. Levels of education were classified as preschool, primary, secondary, higher and don't know. However for this study classes were merged to come up with two categories for maternal education. Women with preschool and

primary level education were classified as women with primary education. Women with higher than primary level education were classified as having higher level of education. This was done in-order to have bigger sample size for each group.

3.5.2.2. Household socio-economic status

The ZDHS 2010-2011 classified respondents by wealth index making it easier for researchers to assess the impact of wealth index on childhood mortality. Respondents were classified as being either very poor, poor, middle, rich or very rich depending on the ownership of moveable and unmoveable goods as indicated in section 3.5.2. For this study wealth index was changed to household socio-economic status (HSES), and due to small numbers of children that were reported dead in each class there was need to merge classes. Households that were classified as very poor and poor households in the ZDHS were collapsed into one category and were classified as households with lower socio-economic status in this study. The second category labelled as higher socio-economic status group consisted of households that were classified as middle, rich and very rich households in ZDHS. This was done in order to have meaningful cases in each category. The inclusion of this variable was necessitated by the fact that previous studies have shown that child survival is greatly influenced by household socio-economic status which can be measured by wealth index (Black, 1984). In addition to this, household socio-economic status measured a variety of services including source of drinking water, household source of power and household toilet facility that have been known to impact on child survival.

3.5.3. Geographical factors (area of residence-rural/urban, province of residence)

According to Basha (2004), geographical factors are factors that relate to a place, a specific area or environment where a particular individual spends a proportion of their time. These include the environmental factors, climate factors, political and economic factors prevailing in that particular area.

3.5.3.1. Area of residence- rural/urban

Huge economic disparities between rural and urban settings have been noted as one factor that result in the mortality differences that have been witnessed in several studies that have found that child mortality to be higher in rural compared to urban areas (Sastry, 1996). In Zimbabwe results from early ZDHS indicate that there are huge child mortality variations between urban

and rural areas (CSO and MacroInternational.Inc., 2000). On the ZDHS questionnaire, the interviewers indicated where the interview was conducted, whether it was a rural or urban setting. As a result this study adopted the classification used for the ZDHS.

3.5.3.2. Province of residence

Bangha and Simelane (2007) in South Africa found that child mortality was not uniform among different provinces in the country suggesting that there could be other factors that are at play in other provinces that are missing in others. The factors could range from quality of air, waste management and waste disposal to climate conditions. The ZDHS had clusters and those clusters were labelled to identify province where the interview was conducted. The provinces that were used for the ZDHS 2010-2011 also apply for this study.

3.6. Distribution of the sample by variables of interest.

The aims and objectives of the study were to investigate determinants of mortality for children born from 2006 to 2010 as reported by women who participated in the ZDHS 2010-2011. In table 3.1 the study presents the distribution of children dead by variables of interest.

Table 3.1: Distribution of children dead by variables of interest, 2006-2010 birth cohort

Background Characteristics	Dead n(%)	Total births n(%)
Age of Mother		
15-19	19 (5.28)	389(6.99)
20-24	104 (28.89)	1,644(29.55)
25-29	103 (28.61)	1,669(30.00)
30-34	69 (19.17)	978(17.58)
35-39	42 (11.67)	620(11.15)
40-49	23 (6.39)	263(4.73)
Child's Gender		
Male	204 (56.67)	2,812(50.55)
Female	156 (43.33)	2,751(49.45)
Maternal Education		
Primary	139 (38.61)	1,941(34.89)
Higher	221 (61.39)	3,622(65.11)
HSES		
Lower	166 (46.11)	2,511(45.14)
Higher	194 (53.89)	3,052(54.86)
Area of Residence		
Rural	252 (70.00)	3,952(71.04)
Urban	108 (30.00)	1,611(28.06)
Province		
Manicaland	66 (18.33)	695(12.49)
Mashonaland Central	42 (11.67)	612(11.00)
Mashonaland East	30 (8.33)	551(9.90)
Mashonaland West	67 (18.61)	651(11.70)
Matabeleland North	14 (3.89)	465(8.36)
Matabeleland South	15 (4.17)	494(8.92)
Midlands	37 (10.27)	611(10.98)
Masvingo	33 (9.16)	560(10.07)
Harare	44 (12.22)	567(10.19)
Bulawayo	12 (3.33)	355(6.38)
Total	**360 (6.47)**	**5,563(100.00)**

Note: Percentages are column percentages and data is weighted

Source of Data: ZDHS 2010-2011

Table 3.1 shows that, a total of 5, 563 births occurred between 2006 and 2010 were reported by women age 15-49. This number was less than what was reported in the ZDHS 2005 where 9,491 births were reported by women age 15-49 who took part in the 2005 survey (CSO and Macro-International.Inc, 2007). In the ZDHS 2010-2011 a total of 360 deaths were recorded for birth cohort of 2006-2010, this number was 243 deaths less than what was recorded in the 2005 survey where 603 under 5 deaths were reported. The number of deaths reported in the

ZDHS of 2010-2011 represents 6.5% of the births reported in the survey that had died. Although the absolute numbers of dead children were lower than those reported in the ZDHS 2005, in terms of percentages the percentage dead was slightly higher compared to those reported in the ZDHS 2005. The age groups that reported the highest percentage of children dead are 20-24 & 25-29 age groups with 28.89% (104) & 28.61% (103) respectively. The age groups with the lowest percentage of children dead were the 15-19 and 40-49 age groups with 5.28% (19) and 6.39% (23) respectively. Although the percentage reported dead by the age group 15-19 is smaller compared to other age groups, it is nevertheless important to note that this percentage was huge considering the fact that children born to mothers in this age group had the shortest exposure to mortality than any other groups.

From table 3.1, it is shown that more male children were reported dead with 56.67% (204) of all the reported deaths compared to female children. Female children constituted 43.33% (156) of all the deaths reported for the period. In terms of the children still alive by gender, data from the ZDHS 2010-2011 also points out that more male children were reported alive at the time of the survey with 50.12% (2,608) compared to female children with 49.88% (2,595) of all the children still alive at the time of the survey (ZIMSTAT and ICF-International, 2012).

Table 3.1 also displays the number and percentages of children that were reported dead by area of residence for the 2010-2011 cohort. The total number of children reported dead in urban areas was 108 and this number represents 30% of all the deaths reported in the survey for the 2006-2010 birth cohort. Most of the deaths that were reported in the survey occurred in rural areas with 70% of all the deaths being reported by mothers residing in rural areas.

Mothers with at least primary education reported 38.61% of all the deaths that were reported in the survey. A higher number of children dead was reported by mothers with higher levels of education with 61.39% of all the deaths reported by mothers in this bracket. The percentage of children dead seem to suggest that children born to mothers with at least primary level education had mortality advantage over those born to mothers with higher than primary education..

3. 7. Population and Sample

According to WHO (2008) (p174) "a study population is that aggregation of elements from which the sample is actually selected". The study population for this study are all the children in Zimbabwe born between 2006 and 2010 (4 years preceding the ZDHS 2010-2011). Data on children were provided by 9,171 women interviewed for the ZDHS 2010-2011. Women of child-bearing age, age 15-49 where asked to provide full birth histories of children ever born. A total of 5,563 births that occurred from 2006 to 2010 were reported by women aged 15-49. The study sample was the 5,563 children born between 2006 and 2010 as reported by women age who took part in the survey. The study was interested in establishing the survivorship probability and also the odds of being reported dead/alive for this birth cohort by selected well known determinants of childhood mortality.

3.8. Quality of data emanating from ZDHS 2010-2011

Data from surveys and censuses used to estimate child mortality can be affected by many errors. According to Allison (2012), retrospective data is bound to have some errors that are predominantly related to recalling of events that happened long time ago. These data errors can subsequently introduce bias and distort the results. Discussed on this section are some of the limitations that might have affected the quality of data as noted by ZIMSTAT and ICF-International (2012)

3.8.1. Investigator bias

Investigator bias occurs when interviewers fail to do their job properly and avoid asking some questions or probe some questions further in an attempt to avoid more work for the interviewer. In the ZDHS of 2010-2011 interviewers were asked to probe further if a respondent answered 1 year or provide any whole number to the question "How old was (NAME) when he/she died?" (ZIMSTAT and ICF-International, 2012). Interviewers were required to record days when child died when less than one month and months if the child died when less than 2 years or years for children above 2 years.

3.8.2. Reporting errors of date of birth

One limitation associated with retrospective estimation of child mortality levels is that information used to estimate child mortality levels depends entirely on the ability of the respondent to recall events that happened in the past and the exact time when events occurred. For example reporting that a dead child was born in the current year when in fact was born in the previous year might lead to the inclusion of that death in the numerator when estimating IMR thereby introducing bias.

3.8.3. Age heaping

This a tendency by respondents to heap age at time of deaths for example at exact 1 or 2 years instead of specifying the actual time of death for example 11 months or 22 months when the event occurred. The same mistake as mentioned above on interviewer bias above can occur if the interviewer fail to probe further to ascertain the actually time when death occurred especially for children under the age of 2. In the ZDHS 2010-2011 interviewers had to probe further to get the actual age of child when the event occurred.

3.8.4. Birth and death omission

One limitation associated with retrospective estimation of child mortality levels is that information used to estimate child mortality levels and determinants depends on the ability of the respondent to recall events that happened in the past. Women might choose not to mention deaths that occurred in the past as a coping mechanism to avoid triggering memories associated with the painful event. Children that died during infancy stages are not sometimes mentioned by women when reporting deaths, due to various factors that include the fact that in some societies children who die during infancy are not countered as births. ZIMSTAT and ICF-International (2012) also note that intentional omission of deaths that occurred in early childhood can result in severe underestimation of rates of mortality.

3.8.5. High prevalence of HIV/AIDS and high adult mortality

In the context of high prevalence of HIV/AIDS and subsequent high adult mortality associated with the pandemic, data related to children who have lost their mothers are not included. This scenario introduces bias as the status whether dead or alive of children born to dead mothers remains unknown. This makes it difficult to safely announce a decline in levels of child mortality or determinants of childhood mortality without considering the effects of the pandemic. The ideal scenario in this case would be to monitor levels and determinants of

mortality over a longer period of time to make informed conclusions on the patterns and the underlying determinants.

3.9. Chapter conclusion

This chapter addressed the methodological issues for the study that included research method, study design, data sources and the sampling structure for the ZDHS 2010-2011. A description of the dependent variable and independent variables of interest for the study was also presented in this chapter. The dependent variable for survival analysis was age at death and for logistic analysis it was status of child whether dead/alive for children age between 0 months to 48 months born from 2006 to2010. Also discussed in this chapter are the independent variables that were grouped into three major groups and the three groups are demographic factors, socio-economic factors and geographical factors. Under maternal and demographic factors, well known determinants of childhood mortality such as age of mother and child's gender were defined in this chapter. The socio-economic factors that were looked at include maternal education and household socio-economic status. Under geographical factors, the effects of area of residence whether rural or urban and province of residence were discussed.

Chapter 4 Results

4.0. Introduction of the chapter

This chapter presents results of the study. The study sought to investigate the determinants of childhood mortality in Zimbabwe between 2006 and 2010 at the height of the economic crisis using data from the ZDHS 2010-2011. Using the proximate determinants and demographic transition theories to guide this study, the study sought to establish the proximate and distal determinants on childhood mortality in a hyper inflationary economic crisis. Factors were grouped into three main groups that are demographic factors, socio-economic factors and geographical factors that impact on child survival. Under demographic factors age of mother and child's gender were investigated. Under the socio-economic factors, the concepts that were investigated include maternal education and household socio-economic status. The last group looked at geographical factors that impact on childhood mortality and in this group the study looked at mortality differentials by area of residence whether urban or rural area and province of residence. Presented in this chapter are results from the three models that were used for data analysis.

4.1. Percentage distribution of children dead by selected variables

The objectives of the study were to identify the determinants of childhood mortality between 2006 and 2010 using data from the ZDHS 2010-2011. According to Reid (1987) percentage distribution helps with easy understanding of relationships between two or more variables. Table 4.1 below displays percentage distribution and odds ratios of childhood mortality as reported by women in the ZDHS 2010-2011. According to ICF-International (2011) it is advisable to do a bivariate analysis of the logistic regression in-order to have an overview of the data. Deaths reported in the table are from births that occurred from 2006-2010 and were reported in the 2010-2011 ZDHS by women age 15-49 who participated in the survey.

Table 4.1: Percentage distribution and odds ratios for children dead by selected variables, ZDHS 2010-2011.

Background Characteristics	Dead n(%)	Total Births n(%)	Odds ratio
Age of Mother			
15-19	19 (5.28)	389 (6.99)	Omitted
20-24	104 (28.89)	1,644 (29.55)	1.32
25-29	103 (28.61)	1,669 (30.00)	1.28
30-34	69 (19.17)	978 (17.58)	1.48
35-39	42 (11.67)	620 (11.15)	1.42
40-49	23 (6.39)	263 (4.73)	1.87**
Child's Gender			
Male	204 (56.67)	2,812 (50.55)	Omitted
Female	156 (43.33)	2,751 (49.45)	0.77**
Maternal Education			
Primary	139 (38.61)	1,941(34.89)	Omitted
Higher	221 (61.39)	3,622(65.11)	0.84
HSES			
Lower	166 (46.11)	2,511(45.14)	Omitted
Higher	194 (53.89)	3,052(54.86)	0.96
Area of Residence			
Rural	252 (70.00)	3,952(71.04)	Omitted
Urban	108 (30.00)	1,611(28.96)	0.95
Province			
Manicaland	66 (18.33)	695(12.49)	Omitted
Mashonaland Central	42 (11.67)	612(11.00)	0.70
Mashonaland East	30 (8.33)	551(9.90)	0.55**
Mashonaland West	67 (18.61)	651(11.70)	1.09
Matabeleland North	14 (3.89)	465(8.36)	0.30**
Matabeleland South	15 (4.17)	494(8.92)	0.30**
Midlands	37 (10.27)	611(10.98)	0.61**
Masvingo	33 (9.16)	560(10.07)	0.60**
Harare	44 (12.22)	567(10.19)	0.80
Bulawayo	12 (3.33)	355(6.38)	0.33**
Total	**360 (100.00)**	**5,563 (100.00)**	

Source of data: ZDHS 2010-2011

**Statistically significant at .05

Percentages are column percentages and data is weighted

4.1.1. Percentage and odds ratios of children dead by age group of mother

A total of 5, 563 children were born to mothers between the ages 15-49 for the period 2006 to 2010. The age group with the most number of births was the 25-29 age groups which had 30% of all the births that occurred during this period, followed by the 20-24 age group which had 29.55% of all the births. The age group 30-34 follows with 17.58% of all the births that were reported in the survey and the age group with the least births was the 40-49 age group which had 4.73% of all the births that were reported for the period under review. Looking at the number of children reported dead for each group, it is also clear that the age groups that reported most births are also the same age groups that reported most number of children dead. Mothers in the age group 20-24 reported 28.89% of all the deaths that were reported in the survey. This age group is followed by the age group 25-29 which reported 28.61% of all the deaths that were reported in the survey. In terms of the lowest percentage, the results indicate that the lowest percentage of children dead was reported in the age group 15-19 which reported 5.28% of all the reported deaths.

Table 4.1 also presents the odds of being dead for each independent variable starting with age of mother. Children born to mothers in the age groups 20-24 were 1.32 times more likely to be reported dead. Children born to mothers in the age group 25-29 were 1.28 times more likely to be reported dead than children in born to mothers in the reference group. For children born to mothers in the age group 30-34, the odds of dying were 1.48 times more than for children born to mothers in the age group 15-19. Children born to mothers in the age group 35-39 were 1.42 times more likely to die than children born to mothers in the age group 15-19. Children born to mothers in the age group 40-49 were nearly twice more likely to be reported dead than those born to mothers age 15-19 and was statistically significant at <.05.

4.1.2. Percentage and odds ratios of children dead by gender, 2006-2010 birth cohort.

Table 4.1 presents the percentage of children reported dead by gender. Mortality was higher for male children with 56.67% of all the reported deaths compared to reported deaths for female children which were 43.33% of all the deaths. The odds of reported dead by gender of child presented in table 4.1 indicate that female children were less likely to be reported dead than male children. The odds of being reported as dead for female children were 0.77. Meaning female children were 23% less likely to be reported dead than males.

4.1.3. Percentage and odds ratios of children dead by mother's education attainment

Table 4.1 also presents the distribution of deaths for the 2006-2010 birth cohort by mother's education attainment. Mothers with primary education reported 38.61% of all the deaths that were reported in the survey. For mothers with higher level of education, the percentage of children reported dead by this group is 61.39%.

The study also estimated the odds of dying for children based on the mother's education attainment and for children born to mothers with higher level of education the odds were 0.84. This indicates that children of mothers with higher than primary education were 0.16 or 16% less likely to be reported dead than children born to mothers with some primary education.

4.1.4. Percentage and odds ratios of children dead by household socio-economic status

Table 4.1 also illustrates the percentage distribution of children dead by household socio-economic status (HSES). In the ZDHS 2010-2011 data, household wealth index was classified as poor, very poor, middle, rich and very rich and this classification reflected the household socio-economic status based on ownership of assets such as electrical goods, cars, bicycles, cattle, access to electricity, housing type, toilet facility and sources of drinking water (ZIMSTAT and ICF-International, 2012). Hence for this study ZDHS wealth index classes were dismantled and two categories were created. In the first category, the categories poor and very poor were merged into one category and classified as households with lower socio-economic status. The second category labelled as higher socio-economic status group consisted of the middle, rich and very rich households. This was done in order to have meaningful cases in each category. The results indicate that 46.11% of all the deaths that occurred during 2006 to 2010, are from households with lower socio-economic status. The households with higher

socio-economic status contributed 53.89% of all the deaths that were reported for the period under review.

Table 4.1 also presents the odds of dying by household socio-economic status while holding other variables constant. The odds of dying for children residing in households with higher socio-economic status is 0.96 meaning that children who came from such households were 0.04 times less likely to reported dead than children from households with lower socio-economic status. By converting this to percentages it shows that children coming from households with higher socio-economic status had better chances of surviving by 4% than children from lower socio-economic households.

4.1.5 Percentage and odds ratio of children dead by area of residence (urban/rural)

Table 4.1 also displays the number and percentages of children that were reported dead by area of residence for the 2010-2011 cohort. The total number of children reported dead in urban areas was 108 and this number represents 30% of all the deaths reported in the survey for the 2006-2010 birth cohort. Most of the deaths that were reported in the survey occurred in rural areas with 70% of all the deaths being reported by mothers residing in rural areas. These comparisons of births and deaths between rural and urban areas are important to note as mortality is usually correlated with high fertility, poor resources and distance travelled to the nearest health service provider among other important factors (Sastry, 1996, Wang, 2003, Rutherford et al., 2010).

The odds of dying for children residing in rural areas were 0.95 indicating a negative relationship, indicating that children residing in rural areas were 5% less likely to be reported dead than children residing in urban areas. This signifies better chances of surviving for children living in rural areas than urban areas before controlling for other variables.

4.1.6. Percentage and odds ratios of children dead by region

Table 4.1 also displays the percentage distribution of dead children by region. The results indicate that Manicaland province reported 18.33% of all the deaths that occurred during the period under review. Mashonaland West followed with 18.61% of all the deaths being reported in this province. Harare, Mashonaland Central, Midlands, Masvingo and Mashonaland East provinces followed with 12.22%, 11.67%, 10.28%, 9.17% and 8.33% of all the reported deaths respectively. As has been noted in previous ZDHS, provinces with the least number of deaths

are provinces that are predominantly Ndebele speaking and they are Bulawayo with 3.33%, Matabeleland North 3.89% and Matabeleland South with 4.17%. It is also important to note that the provinces with high numbers of children dead have also a high number of births and the regions with less number of children dead have also less number of births. The inclusion of region in this study was necessitated by the fact that earlier ZDHS have found that child mortality was not uniform in the country. It became important to investigate determinants and note if there were any mortality differentials by province during the economic crisis.

Table 4.1 displays the odds of being reported dead by regions, with Manicaland province being the reference province. All the provinces except Mashonaland West showed a negative relationship between being reported dead and residing in those regions. Children residing in Mashonaland Central were 30% less likely to be reported dead compared to children residing in Manicaland province. For children residing in Mashonaland East the odds of being reported dead were 0.55 and was statistically significant at <.05, indicating that children in Mashonaland East were less 45% less likely to be reported dead than children residing in Manicaland province. Children residing in Mashonaland West were 1.09 times more likely to be reported dead than children residing in the reference province. Both Matabeleland North and South had odds ratios of 0.30 and statistically significant at <.05, which translates to the fact that children from both provinces were less likely to be reported dead 0.70 or were 70% less likely to be reported dead than those residing in Manicaland province. The odds ratio for Bulawayo province was 0.33 again this being a value less than 1 this indicates a negative relationship. Showing that children in Bulawayo were 0.67 times less likely to be reported dead than those in Manicaland province. The odds of being reported dead for children residing in Masvingo and Midlands were 0.60 and 0.61 respectively and statistically significant at .05. This indicates that children residing in these two provinces were less likely to be reported dead than children residing in Manicaland province. For children residing in the two biggest cities that are Harare and Bulawayo, the odds of being reported dead were 0.80 and 0.33 respectively. Again since this is less than 1, it indicates that children residing in these cities were less likely to be reported dead than children residing in the reference province. The odds ratio for Bulawayo was statistically significant at .05.

4.2. Results of Multivariate Logistic Regression Analysis

Table 4.2: Nested logistic regression model by selected variables, 2006-2010 birth cohort

Independent Variable	Model I Odds Ratio	Std Err	Model II Odds Ratio	Std Err	Model III Odds Ratio	Std Err
Demographic Factors						
Age of mother(15-19)						
20-24	1.32	0.34	1.35	0.35	1.27	0.33
25-29	1.29	0.33	1.31	0.34	1.27	0.33
30-34	1.48	0.40	1.50	0.40	1.43	0.38
35-39	1.43	0.41	1.43	0.41	1.33	0.38
40-49	1.88**	0.60	1.83	0.59	1.83	0.59
Child's gender(male)						
Female	0.77**	0.08	0.76**	0.08	0.76**	0.08
Socio-economic factors						
Maternal Education (Primary)						
Higher			0.84	0.10	0.83	0.10
Household SES(Lower)						
Higher			1.02	0.12	0.88	0.12
Geographical Factors						
Area of residence(urban)						
Rural					0.83	0.15
Province (Manicaland)						
Mashonaland Central					0.68	0.14
Mashonaland East					0.56**	0.13
Mashonaland West					1.05	0.19
Matabeleland North					0.28**	0.08
Matabeleland South					0.29**	0.09
Midlands					0.60**	0.13
Masvingo					0.58**	0.13
Harare					0.75	0.19
Bulawayo					0.31**	0.11
Log likelihood	**-1328.42**		**-1327.34**		**-1298.55**	

Statistically significant at **05
Note: Omitted Variables are in brackets

4.2.1. Determinants of childhood mortality

Table 4.2, model 1, presents the odds ratios of being reported dead by selected variables. In model I, the study controls for age of mother and gender of child. The results show that the odds of being reported dead for children born to mothers in the age groups 20-24 were 32% higher than for children born to mothers in the age group 15-19 which was the reference group. For children to mothers in the age groups 25-29, 30-34, 35-39 the odds of being reported dead were higher at 29%, 48% and 43% respectively, indicating higher chances of dying compared to children born to mothers in the reference group. The odds ratio of being reported dead for children born to mothers in the age category 40-49 was 1.88. This indicates that children born to mothers in the age category 40-49 were almost twice more likely to die than children born to mothers in the reference group and was statistically significant at .05.

In model 1 the study also investigates the odds of a child being reported dead by gender. The odds of dying for female children was 0.77 and was statistically significant at .05. Since this is less than 1 it shows that female children were 0.23 times less likely to be reported dead compared to male children. In terms of percentages, it shows that females were less likely to be reported 23% of the time than male children.

Model II in table 4.2 introduces independent variables maternal education and HSES in a model that controls for age of mother and gender of child. This changes the values of the odds ratios for age of mother. The odds of being reported dead for children born to mothers in the age group 20-24, increases from 1.32 to 1.35. The odds ratios for age groups 25-29 and 30-34 increases from 1.29 to 1.31 and from 1.48 to 1.50 respectively. The odds for age group 35-39 remain the same at 1.43. For the age group 40-49 the odds of being reported dead decreases to 1.88 to 1.83. Since the odds ratios are still positive it means the relationship between age of mother and being reported dead intensifies with the introduction of maternal education and HSES. For child's gender the introduction of the variables maternal education and HSES changes the odds value slightly to 0.76 and remains statistically significant at .05. The odds ratio for mothers with higher level education were 0.84, indicating that children born to mothers with higher education were 16% less likely to be reported dead than children born to mothers with primary level education. The odds of being reported dead for children from households with higher HSES were 1.02, indicating that children from such households were 2% more likely to be reported dead than children from households with lower HSES.

In model III, the study introduces independent variables area of residence whether urban or rural and region in a model that controls for age of mother, child's gender, maternal education and HSES. With the introduction of these two independent variables the value of the odds ratios for age of mother decreases slightly but the relationship remains positive, indicating that the odds of being reported dead by age group of mother remains higher regardless of maternal education and HSES. For children born to mothers in the age group 40-49 the odds of being reported dead remains the same as in model II but also shows that children born to mothers in this age group were 83% more likely to be reported dead than children born to mothers in the reference age group. The odds of being reported dead for female children remains at 0.76 and statistically significant at .05. Meaning female children residing in rural areas were 24% less likely to be reported dead than male children.

The introduction of area of residence and region also alters the odds of being reported dead by maternal education. For children born to mothers with higher levels of education, the odds of being reported dead decrease slightly from 0.84 to 0.83. This shows that children born to mothers with higher than primary education were less likely to be reported dead than children born to mothers with some primary education. With the introduction of area of residence and region, the odds of being reported dead by HSES changes from a positive to a negative relationship. The odds of being reported dead changes from 1.02 to 0.88. This shows that for children residing in rural areas and residing in households with higher socio-economic status were 12% less likely to be reported dead than children residing in urban areas and coming from households with lower socio-economic status. The variable area of residence whether rural or urban has received its fair of attention from researchers, with several studies noting mortality advantage for children residing in urban areas over those residing in rural areas. Inclusion of area of residence was necessitated by the rural/urban mortality dynamics witnessed in other studies. Again table 4.2 shows the odds ratios of dying for children residing in rural areas and were 0.83. This indicates that children residing in rural areas were 0.83 times less likely to be reported dead than children residing in urban areas.

Table 4.2, model III also displays the odds of being reported dead by region, the omitted region being Manicaland province. The odds of being reported dead for children residing in Mashonaland Central were 0.70. This shows that children residing in Mashonaland Central province were 0.30 times less likely to be reported dead than those residing in Manicaland province. The odds of being reported dead in Mashonaland East were 0.57 and was statistically significant at .05. This also indicates that children residing in Mashonaland East were 0.43

times less likely to be reported dead than those residing in Manicaland province. The odds ratio for Mashonaland West were 1.07, and this value being above 1 indicates that children in Mashonaland West were 1.07 more likely to be reported dead than children in Manicaland province. The odds of dying for Matabeleland North and South were reported as 0.28 and 0.30 respectively and statistically significant at .05. As has been described elsewhere in this study, the odds ratios showed a negative relationship between being reported dead and residing in the two provinces. Children from Matabeleland North and South were 0.72 and 0.70 times less likely to be reported dead respectively than those residing in Manicaland province. The odds of being reported as dead in Midlands province were 0.62 and statistically significant at .05. Since this is less than 1, it shows us that children residing in Midlands were 0.38 times less likely to be reported dead than children residing in Manicaland province. The odds of dying for children residing in Masvingo was reported as 0.60 and again was statistically significant at .05.The odds ratio reported here signifies that children in Masvingo province were 0.40 times less likely to be reported dead than children residing in Manicaland province. The odds of being reported dead for children residing in Harare province were 0.79 and were not statistically significant. Children residing in Harare were 0.21 times less likely to be reported dead than those residing in Manicaland province. The odds ratio for Bulawayo province were reported as 0.35 and was statistically significant at.05. Since this was also less than one it shows that children residing in Bulawayo were less likely to be reported dead than those residing in Manicaland province.

4.3. Survival analysis

Survival analysis is concerned with measuring time to event, in the case of this study the event was childhood mortality and the time to event is the age of the child at timing of death. Children who were reported alive during the survey were included in the analysis but were censored. Censoring of events allows for making comparisons between uncensored cases and those at risk of experiencing the event. According to (Allison, 2012), censored cases are cases that have incomplete survival time because they have not experienced an event at the end of the study. One analytical approach of the survival analysis was used and it is the Kaplan-Meier method which is a nonparametric approach.

4.3.1. Differentials in childhood mortality by selected variables

Figure 4.0 is the KM graph which gives a general overview of the pattern of mortality for the 2006 to 2010 birth cohort before modelling. The graph shows that the probability of mortality was highest (1.00) in the first month of life and as survival time increases, the probability of mortality declines significantly to 0.50 by the second month and continues to decrease to approach zero by age of 48 months. From the graph the median survival time for the cohort is 3 months. According to UNAIDS (2010), median survival time is the earliest time at which the curve goes below 0.50. Although this pattern of mortality is in line with what is usually expected, the probability of mortality is still exceptionally high in infancy indicating the challenges that needs to be addressed. Generally all the graphs presented on this section show that survivorship probabilities are very low indicating high rates of mortality in early years of life. In societies where there are low mortality rates in childhood, the survivorship curve would remain around 1.00 for a longer period and decrease gradually approaching 0 as people grow older and rise again towards 1.00 in old age.

Figure 4.0. Kaplan-Meier survivorship probabilities for 2006-2010 birth cohort.

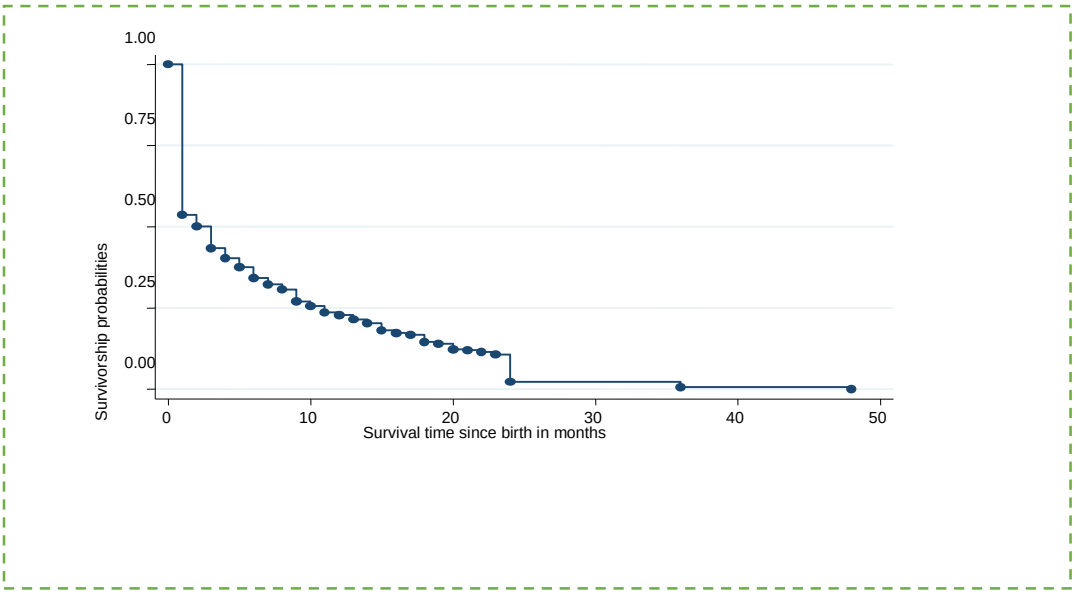


Figure 4.1. Kaplan-Meier survivorship by child's gender, 2006-2010 birth cohort.

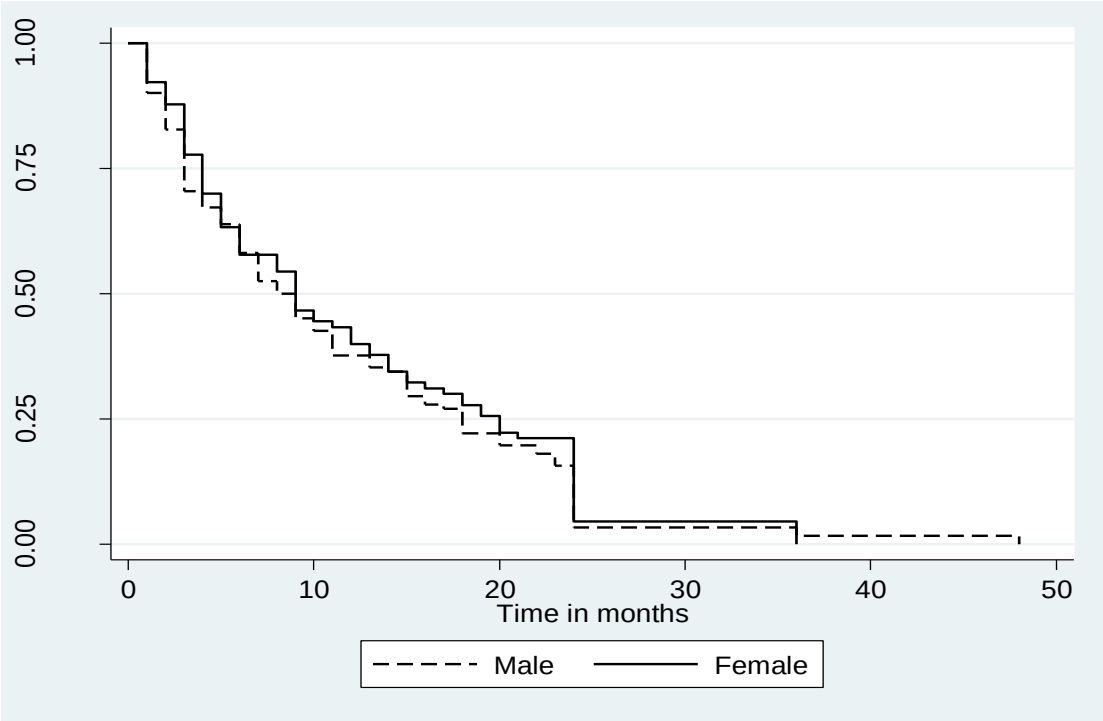


Figure 4.1 is the KM graph illustrating the survivorship probability by child's gender for the 2006-2010 birth cohort. From the graph it is visible that from birth survivor functions for both female & male children follow identical paths until the second month. From then male children have slightly lower survivorship probability until 6 months when both sexes are exposed to similar forces of mortality. The median survival time of 7 months is similar for both sexes. Survivorship probabilities for male children continue to be lower from 8 month to about 24 months when paths merge both female and male follow similar path of mortality. However the survivorship probabilities for female children approach 0.00 at about 37 months and 11 months earlier than male children. These results indicate that female children are exposed to forces of mortality for a shorter period compared to males. This indicates that female children had better chances of surviving beyond 48 months compared to male children during the economic crisis.

Figure 4.2.Kaplan-Meier survivorship by maternal education, 2006-2010 birth cohort

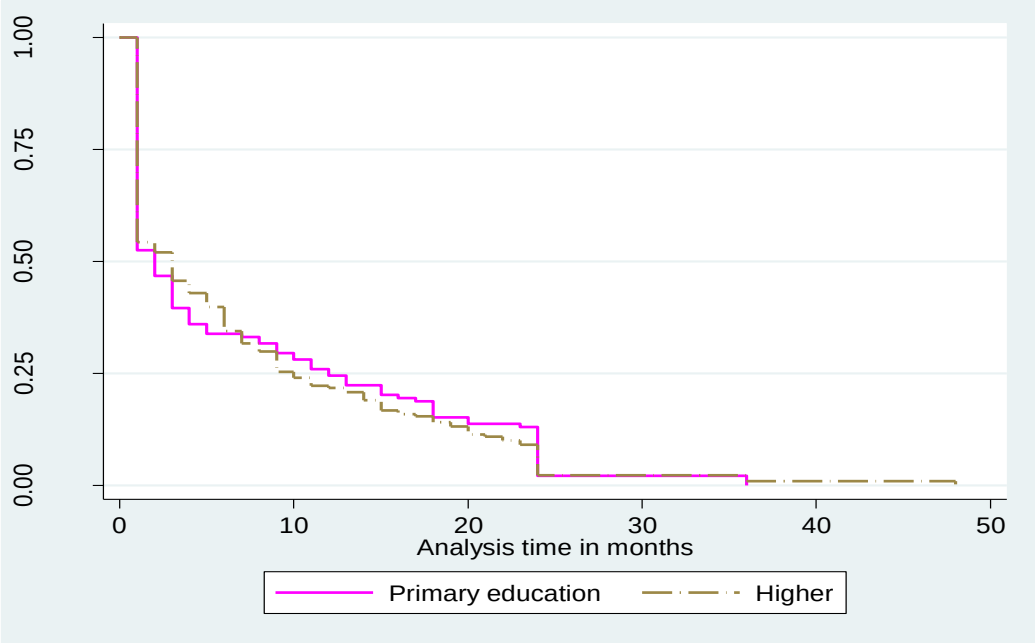
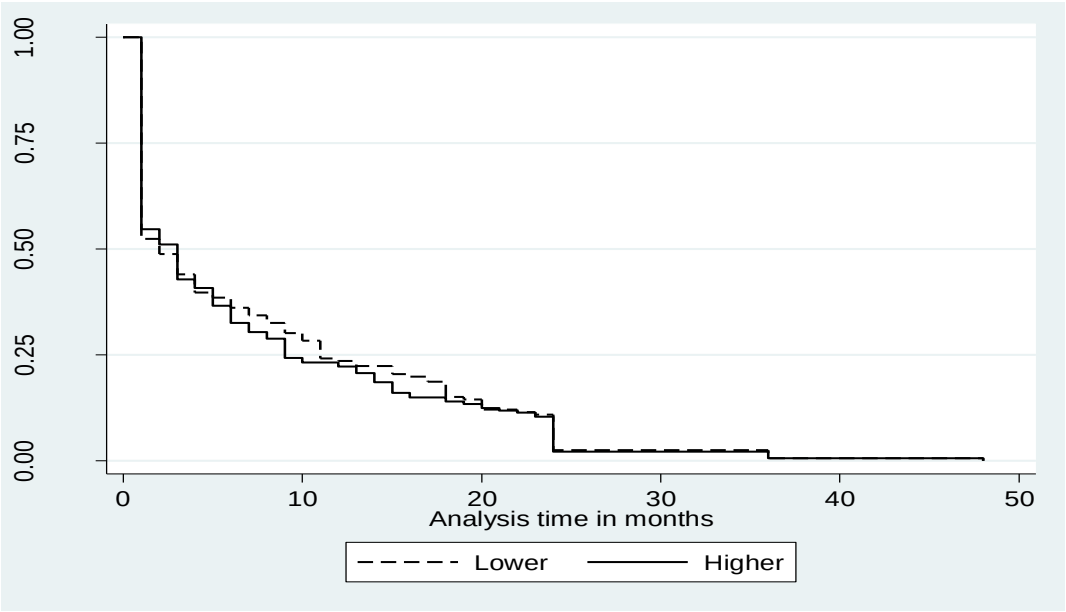


Figure 4.2 is the KM graph which shows the survivorship probability by maternal education. The graph shows that from birth children born to mothers with primary education and those born to mothers with higher levels of education were exposed to similar hazards of mortality until about 2 months. From 2 months to about 8 months, children born to mothers with primary education have lower survivorship probabilities indicating that mortality rates for such children was higher than mortality rates for children of mothers with higher education. From about 8 months to about 24 months, children of mothers with higher education are exposed to higher mortality rates hence their survivorship probabilities are lower. From the graph it is illustrated that children of mothers with primary education are exposed to forces of mortality until around

the age of 36 months when their probabilities approach 0.00. On the other hand, children born to mothers with higher education continue to be exposed to forces of mortality until the age of 48 months. The results suggest that children born to mothers with primary education had better chances of surviving beyond 5 years compared to those with mothers with higher levels of education. The results partly support findings from (Basu and Stephenson, 2005), who acknowledge that even little maternal education is beneficial to the welfare of children.

Figure 4.3 Kaplan-Meier Survivorship probability by household socio-economic status



According to (ZIMSTAT and ICF-International, 2012), household socio-economic status was measured based on ownership of assets such as electrical goods, cars, bicycles, cattle, access to electricity, housing type, toilet facility and sources of drinking water. Figure 4.3 illustrates the survivorship probabilities by household socio-economic status. The KM graph shows that from birth, children from both households with lower and higher socio-economic status are exposed to higher risk of mortality until the age of 2 months when the probabilities drop significantly to about 0.50 for both categories. From about the age of 2 months until the 4th month, children from lower socio-economic status households continue to be exposed to higher mortality rates as indicated by the lower survivorship probabilities shown in the graph. Children residing in households with higher socio-economic status are exposed to lower survivorship probabilities from about 5 months until just about 38 months when mortality for

both emerge. The results presented on the graph also show that children residing in households with higher socio-economic status continue to be exposed to forces of mortality until the age of 48 while children residing in households with lower socio-economic status are exposed until 37 months.

Figure 4.4. Kaplan-Meier survivorship by area of residence for 2006-2010 birth cohorts

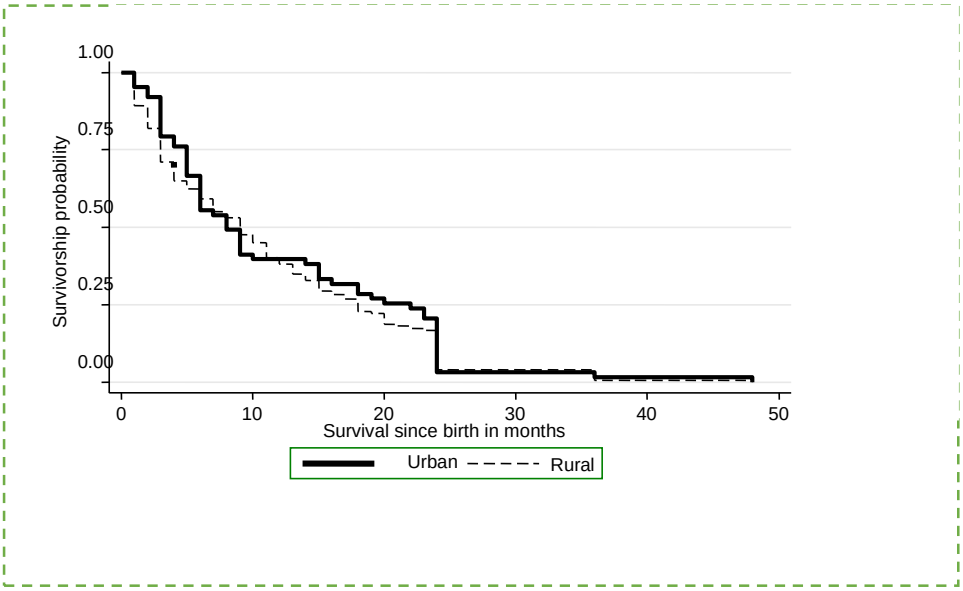


Figure 4.4 is the KM graph which compares the probability of mortality between children residing in the rural areas against those residing in the urban areas. The graph indicates that from birth to second month, children from both rural and urban areas are exposed to similar risk of dying but the risk of mortality for children residing in urban areas improves slightly from second month to 6 months and during the same time children residing in rural areas have lower survivorship probabilities, indicating they experienced high mortality. From 7 months to 10 months, children residing in urban areas exhibit lower survivorship probabilities indicating they had higher mortality rates compared to children residing in rural areas. This scenario coincide with the time when children of this age start to experience and discover the outside world by way of moving around and use their sense of taste. It is also important to note that when the outside environment is not conducive and is riddled with diseases, children of this age become vulnerable. Considering the period under review, children age between 7 to 10 in urban area settings were exposed more as they crawled around households with overflowing sewage. From 10 to 24 months, children residing in rural areas have lower survivorship probabilities compared to those residing in urban areas indicating that they experienced high

mortality rates. At 24 months survivorship probability for two groups converge at around the same time and approaching 0.00. The convergence witnessed around 24 months continues until 48 months. Survivorship probabilities illustrated in the graph suggest that generally children residing in urban areas have better chances of surviving compared to children residing in urban areas.

4.4. Chapter conclusion

Chapter 4 presented results of survival analysis, descriptive, logistic regression analysis and survival analysis. The method of survival analysis used for this study is Kaplan- Meier estimator which graphed the survivorship probability. Chapter 4 also presented results of the logistic regression analysis. Odds ratios produced in logistic regression showed the odds of dying by the independent variables. The logistic regression model was statistically significant at p-value<.05. The use of three models for data analysis is validated by the evidence that, although survival analysis was the most suitable model to use considering the type of data the study was using, there were some noticeable concerns. The first concern was the fact that the Cox model that was used for analysing survival data was statistically insignificant. Although the Cox proportional hazards model was not statistically significant, the results revealed substantive significance. Furthermore the direction of the relationship among variables that was produced in Cox regression was later supported by the logistic model which was statistically significant. According to Newton & Rudestam (1999), it is risky for researchers to dismiss results emanating from models that are statistically insignificant as statistical significance is usually determined by many factors that include sample size. This was also supported by Hobcraft, McDonald & Rutstein, (1985) when they note that the Cox model is extremely sensitive to smaller sample sizes especially the sample of uncensored cases or the cases that experienced an event. Hobcraft, McDonald & Rutstein (1985) further note that smaller sample sizes of uncensored cases therefore tend to produce statistically insignificant although the results produce more precise direction of the relationship for variables of interest. For this study only 360 children were reported dead for the period under review and this could have affected the significance of the model.

The second justification for using survival analysis and logistic models to complement each other was the fact that, according to Vittinghoff, et.al, (2012) both methods are from the same family of what they termed multi-predictor regression methods. The authors highlight that the multi-predictor regression analysis methods are used to communicate the role of many

independent variables to dependent variable and each regression method in this family plays a different role with an aim of achieving diverse outcomes. The authors further acknowledge that although regression models in the family might differ in how they handle statistical data, they all share some similarities and therefore allow researchers to combine one or two models to analyse data fully. For example survival regression analysis and logistic regression analysis can handle binary outcome variables. In case of this study while survival analysis would measure time to occurrence of an event (childhood mortality between 0-48 months by independent variables), logistic regression analysis would estimate the probability of an event (childhood mortality by independent variables) occurring thereby complementing each other.

CHAPTER 5 Conclusion and Recommendations

5.0. Introduction of the chapter

This study sought to investigate the factors that influenced childhood mortality during the economic crisis in Zimbabwe. Among the questions that were asked are: 1) What were the determinants of child mortality in Zimbabwe during the period; 2) Are the determinants of childhood mortality as proposed by Mosley and Chen (1984) relevant in a country faced with economic challenges? To what extent were Caldwell's propositions regarding childhood mortality, and in particular the role of maternal education therein, relevant in economic crises? Are there any mortality differentials by subgroups, for example female children against male children, rural and urban mortality variations, lower household socio-economic status against higher household socio-economic status? In seeking to answer these questions, the study also referred to the frameworks such as the proximate determinants framework and demographic transition theory.

5.1. Key results

5.1.1. Age of mother as a determinant of childhood mortality

The results from this study, indicate that child mortality was partly associated with age of mother. The odds of dying were different for children born to mothers in different age groups. The odds of dying was highest among children born to mothers in the age group 40-49 where children had 88% chances of dying compared to children born in the age group 15-19. What was new, in view of other studies, however, was the higher odds of dying that were displayed for children born to mothers between the ages of 20 to 35 years. For example, in most studies that have investigated the effects of age of mother on childhood mortality, a pattern which has been described as a U shaped pattern has been noted. Where children born to both very young mothers and older mothers experience heavy mortality but those that are born to mothers in other age groups faring much better (Hobcraft et al., 1984, Kembo and Van Ginneken, 2009, Trussell and Pebley, 1984).

5.1.2. Child's gender as a determinant of childhood mortality

The results of this study show that during the economic crisis the odds of dying were lower for female children compared to that of male children and was statistically significant at .05 in all models. This indicates that female children had better chances of surviving beyond 5 years than male children. The results support findings by G.o.Z and UN (2010) that have noted that in most developing countries, females have an advantage in survival to age 5. UN (2011) further notes that female mortality advantage in developing countries has continued to increase despite general mortality decline. The results from this study could stimulate other studies to investigate further on the matter. Female and male mortality differentials have been noted in societies that have a certain gender preference. For example several studies that have been carried out in the Asian context including Hill and Upchurch (1995) and Arnold et al. (1998) have found huge mortality differentials between male and female children. In these societies male mortality advantages were noted. However the issue of mortality differentials by gender in the African context has not received much attention from researchers, hence the inclusion of this determinant for further investigation.

5.1.3. Maternal education as a determinant of childhood mortality

The results from this study indicate that the odds of dying for children born to mothers with higher education level were lower compared to children of mothers with lower education level. The results confirm findings from several studies that have linked child survival to maternal education. The fact that child survival in general benefit from maternal education has received considerable attention from researchers, for example (Caldwell, 1986, Caldwell, 1990, Caldwell, 1992, Black et al., 2003). The results from this study support findings from these studies that have noted higher chances of survival for children born to mothers with higher levels of education. Several reasons have been cited as contributing to this scenario and they include the ability by mothers with higher levels of education to fully utilise the resources available for the benefit of the children. Caldwell (1979) points out that maternal education remains important in many developing nations even when controlling for other factors such as paternal education and household socio-economic status.

5.1.4. Household socio-economic status as a determinant of childhood mortality

The odds of dying for children residing in households with higher socio-economic status were 2% higher compared to children residing in households with lower socio-economic status in a model that controls for age of mother, gender of child and maternal education. However in a

model that controls for age of mother, child's gender, maternal education, area of residence and province of residence, the odds of dying for children residing in households with higher socio-economic status are 12% lower than children residing in households with lower socio-economic status. The results for the second model are unusual but they could be a reflection of the status of affairs in Zimbabwe during the period under review. Nevertheless the odds in the third model show a pattern that has been noted in other studies (Schultz, 1984, Bradshaw et al., 2003) where children residing in households with lower socio-economic status have mortality disadvantage compared to children residing in households with higher socio-economic status. However the odds presented in this study indicate that higher household socio-economic status only made a positive impact when controlling for area of residence whether urban or rural and province of residence.

5.1.5. Childhood mortality variations by area of residence

Results presented in chapter 4, indicate that the odds of dying for children residing in rural areas were 17% lower than those for children residing in urban areas. These results although unusual might be a reflection of the status of service delivery in urban areas during the period under review, which was characterised by non-treatment of raw sewage before recycling, persistent breakdown of sewage systems and erratic water supply. This scenario transformed many residential areas in urban areas into poor neighbourhoods. Pickett & Pearl (2001) in Wang (2003) recognise that child health outcomes are poor in poor neighbourhoods in urban areas. In some cases the health outcomes for children residing in poor neighbourhoods in urban areas are worse off than for children residing in rural areas. This is particularly true in informal urban settlements where there are no adequate services such as protected sources of drinking water and toilet facilities, according to Wang (2003) citing Wang, Hughes & Fan, (2002). This is further supported by Black et al. (2003) who note that although most child deaths in developing countries occur in rural areas, children who reside in urban slum areas are at the similar risk of dying as those in rural areas. Mortality differentials that have been witnessed in many studies have found that children residing in rural areas are likely to die more during the first five years of life than their counterparts in the urban areas (Wang, 2003, Sastry, 1996). Reasons that have been noted as working against child survival in rural areas include lack of resources, lack of well-trained personnel, poor infrastructure such as proper roads and clinics/hospitals and lack of drugs (Wang, 2003).

5.1.6. Childhood mortality variations by province of residence

Region of residence played an important role in the overall survival of children under the age of 5. Children residing in 8 of the country's 10 provinces were less likely to die compared to Manicaland province which was the reference group. The only province which showed higher chances of dying was Mashonaland West. This also means that even some of the poorest provinces such as Matabeleland North and South performed better than Manicaland province where there are better road networks and better resources. These results show that childhood mortality was not uniform in Zimbabwe. These findings are in line with other studies (Root, 1997, Marindo and Hill, 1997) that have noted lower child mortality in poorer provinces such as Matabeleland North and South. According to Root (1997) this trend has been noted in all the DHS and censuses conducted in the country since 1980. It is also important to note that despite the fact that provinces that are poor continue to perform better in terms of child mortality; these provinces are less populous than provinces that performed badly on child mortality. According to ZIMSTAT and ICF-International (2012), Matabeleland North has 6% of the total population and Matabeleland South and Bulawayo both have 5% of the countries' population. On the other hand some of the provinces that performed badly have higher population density, for example Mashonaland West which has 11% of the country's total population. Provinces such as Matabeleland North and South and Bulawayo provinces continued to present better chances of surviving for children under the age 5. These results are similar to the results reported in demographic and health surveys in the country since 1988 and also results of a study that was conducted by Root (2001) which noted mortality differentials among the country's provinces.

5.2. Conclusions and recommendations

In conclusion, this descriptive cross-sectional study used data from the ZDHS 2010-2011 in order to determine determinants of child mortality during a time of economic recession. Descriptive, multiple logistic regression and Kaplan-Meier methods were applied. The key findings suggest that child mortality was associated with age of mother, maternal education, area of residence, province of residence and gender of child. We can therefore conclude that these factors were important in affecting child mortality during the period and within the economic circumstances specified. These factors may require to be taken into account in efforts that seek to address child mortality especially in settings that are experiencing social and economic crises. Having said this, two factors are important. Firstly, as a descriptive study, the specific mechanisms by which the factors influence child mortality were not determined. In

other words, no causal relationship can be claimed. Similarly, being cross-sectional, the study did not compare the determinants of child mortality with another period in Zimbabwe other than the index. Further analyses that include longitudinal and qualitative designs may shed further insights into associations observed and possible causative mechanisms. Even so, while similar analyses have been carried out elsewhere in Africa, these are limited, were done in some time back, and in settings that are culturally and politically different from Zimbabwe, and where the severity of the economic crises likely different. This, therefore, to our knowledge is the first study in Zimbabwe to examine child mortality determinants during a severe economic crisis. On the basis of the findings, the following are recommended:

- Broadening the analysis to include many African countries that have gone through economic recessions could have given a broader understanding of determinants of child mortality in economic crisis situations. Therefore it is recommended that investigations on determinants of mortality during economic recessions be carried out including different countries.

- The study of child mortality could benefit from investigating the role that primary health care and mobile community based primary health care facilities played in averting more deaths during the economic crisis situation. Furthermore the study of child mortality can benefit by investigating the role that can be played by mobile telecommunication technology in preventing child mortality. According to Berger et al. (2012), Africa is one of the fastest growing users of mobile cell-phone technology and as of 2011 it was estimated that there were more than 620 million mobile connections on the continent. In the same report it is alleged that this makes the continent the second biggest consumer of mobile networks. This technology can be harnessed for the overall improvement in child welfare as parents and caregivers have improved communication with health facilities and transport owners. Mobile phones can also be used by health providers to disseminate information about current immunization activities and outbreaks of diseases such as cholera through short messages services (SMSs).

- It is also recommended that during economic recession there should be at least a temporary abolishing of user fees by both private and government institutions for children under 5 so as to avert unnecessary deaths.

- There is also need to investigate the issue of childhood mortality differentials by gender over a longer period of time in the African context, where the issue has not received much attention from researchers and policy implementers.
- In Zimbabwe the provinces that continue to do badly in terms of child survival and policy implementers should investigate further to see factors that are working against child survival in those provinces.
- Regular sharing of information between and among provinces that are performing well and those not performing so well in terms of child survival could go a long way in preventing child mortality in all the provinces of the country.
- The study looked at determinants of childhood mortality for a shorter period of time and looking at determinants for a longer period could have broadened the analysis to see changes over time.

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